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15 WAYS TO TELL A NEUROTIC

by Albert Ellis

Condensed from a chapter of the book, How To Live With a Neurotic

BASICALLY, a neurotic is an individual who consistently acts illogically, irrationally, and childishly. Although theoretically he is able to think for himself and plan his days for effective, happy living, he actually falls back on unintelligent behavior, failing to attain some of his most desired goals and sabotaging his own best potentialities.

Is it, then, easy to recognize a neurotic when you meet one?

Not necessarily. For there are many truly stupid people around. These individuals, because of inherited or early-acquired mental defects, simply cannot think clearly, act grown-up, or do things effectively.

Neurosis, moreover, should not be confused with mere unhappiness. Some people — millions, in fact — can't help but be unhappy. Take, for instance, those who do not have enough to eat or who are chronically ill. How could they be very happy?

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Neurotics, then, are individuals who are unreasonably and unnecessarily bothered or bewildered. They are more unhappy, or inefficient, or fearful than they need be. A great many of them have more than enough good looks, high intelligence, and fine talents to get along successfully in this world. But somehow they don't. That "somehow," which comes between their potential abilities and their actual achievements— that is their neurosis.

One of the fundamental reasons it is not always easy to say who is and

who is not emotionally disturbed is that neurotics are great cover-uppers. The last thing they want known is how neurotic they are.

In view of some of the confusing evidence and of our own inability to see inner contradictions and unconscious conflicts, how can we tell a neurotic from a so-called normal or well-adjusted individual? Mainly, by recognizing his most important neurotic symptoms. Fifteen of the most important symptoms of emotional disturbance are these:

1. Indecision, doubt, and conflict. Neurotics are often indecisive, hesitant, doubtful. They are afraid to make a mistake, afraid of failure. So they waver, decline to make decisions, refuse to commit themselves or to take full responsibility for anything.

One neurotic girl I knew left her husband to live with another man, but then kept finding fault with her lover because he lacked some of the characteristics of the husband. She wavered between the two, and literally shuttled back and forth between them several times, before she finally was able to see that it was not their traits but her own indecisiveness which constituted the real issue.

When she faced this fact, and started to work seriously on her own problems, she had no trouble in making up her mind—in this instance in favor of the husband.

2. Fear and anxiety. Virtually all neurotics are irrationally afraid of something. On the surface, they may be the fearless, mountain-climbing type. But underneath they are afraid of what people think, of doing the wrong thing, of not having others love and approve of them. Sometimes they honestly know and admit this. But more often, they translate their fears of social and self-disapproval into more concrete phobias, such as the fear of walking on the street, or of being cooped up at home. Look beneath a neurotic's defenses and you will invariably find an irrational dread.

3. Inadequacy feelings. Emotionally disturbed people usually feel that they are inadequate, worthless, or wicked in certain ways. They think that they should be this, and are, alas, only that. They do not merely recognize their own faults; they magnify them. And, above all, they think it is wrong for them to have any failing; they blame themselves incessantly for the failings they believe they have.

4. Guilt and self-blame. Troubled people are usually severe moralists. They blame others and themselves for innumerable desires and deeds. They have particular difficulty in accepting their own sex drives, but they also condemn themselves for many nonsexual things they do. They tend to be too conscientious in their thoughts and too lax in their actions. They know what they should do—

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and don't do it. Then they berate themselves unmercifully.

5. Hostility and resentment. Many neurotics are hostile and aggressive. Hating themselves, they tend to hate others. Feeling that the world is doing them in, they want to retaliate in kind. Being frustrated, largely by their own irrational behavior, they often respond with aggression against the frustrating society they live in.

6. Self-deceit and lack of realism. Virtually all neurotics lie to themselves and refuse to accept reality the way it is. Instead of squarely facing their frustrations, admitting their failings, and accepting the grim facts of life, they tend to rationalize, evade issues, blame others, and generally construct a picture of the world that is more poetry than truth.

• Although this may seem a paradox, all exact science is dominated by the idea of approximation. When a man tells you that he knows the exact truth about anything, you are safe in inferring that he is an *in*exact man.
—Bertrand Russell

7. Rigidity and compulsiveness. Neurotics feel unsafe, insecure. In an effort to attain a greater degree of security, they frequently devise magical rituals and formulas—such as going through a studied routine before bedtime—to give themselves a feeling that some unknown power is protecting them as long as they stick closely to their chosen formulas.

One of the college students I was treating always took six sharply-pointed pencils into every examination and lined them up neatly in front of her. Then she proceeded to ignore them entirely and to use a ballpoint pen for the exam. The pencils gave her a feeling of reserve strength — in case something happened to her pen. More importantly, they served to make her feel that if she temporarily forgot anything that she had studied, the information was really still stored in her mind and could be recalled, just as the pencils could be used in case of pen failure.

8. Shyness and withdrawal. Believing that they may easily do the wrong thing and that others will spot their mistakes, many neurotics become shy and withdrawn. Constructively, they may follow useful occupations which demand solitude, such as working alone in a laboratory or being a forest ranger. Destructively, they may avoid people, stay alone in their rooms, and literally become hermits. In that way they find themselves in one of the frequent neurotic vicious circles: because they are afraid of people they withdraw from society — and thus become more afraid of people.

An extreme case was that of a 22-year-old boy who had immense difficulty getting up in the morning. When he finally did start for work, he would stand in a corner of the train so that others could not see him. He took his lunch to work and remained alone in his office to eat it. When he returned home at night, he ate quickly and then went right to bed.

He was so shy that he literally could never look other people in the eye. When at last he managed to do

this without blushing and quickly averting his gaze, he was as happy as anyone else would have been at making a varsity football team or winning Phi Beta Kappa honors.

9. Antisocial or psychopathic behavior. Many neurotics try to compensate for their feelings of inadequacy by becoming "tough guys." A few of these go to real extremes and become unregenerate juvenile delinquents or adult criminals. Although some psychologists view these so-called psychopaths as special kinds of warped personalities, my own experience with scores of them convinces me that, at bottom, their "psychopathy" is a defensive covering to harden themselves against underlying feelings of rejection, self-pity, and supersensitivity.

10. Unhappiness and depression. A few emotionally troubled people manage to compensate for their inner insecurity and remain outwardly content. But the average disturbed person is either steadily or sporadically unhappy and depressed. He tends to be filled with self-pity and pessimism. His unhappiness does not, by itself, prove that he is neurotic, but such unhappiness is a frequent by-product of neurosis.

11. Self-centeredness and inability to love. Most neurotics have an inordinate desire to receive, and an infinitesimal ability to give, love. They are so concerned with themselves that they have neither the time, the energy, nor the inclination to care for another human being. Neurotics often fall violently in love; they become obsessed with individuals whom they would like to have love them. But they have little ability to love: to want to help another person achieve his own growth and happiness for his own ends.

One of the first girls I dated, when I was in my teens, had a tremendous need to be loved. When she met a boy whom she believed was the right answer to her need for love, she became violently attached to him, insisting she loved him passionately.

As soon as she discovered that her beloved was not exclusively interested in worshiping her, but had some deep-seated needs of his own, she took the discovery as an absolute betrayal, insisted that the boy did not "really" love her, and broke off with him in order to start seeking a new great love.

This ceaseless, fruitless search for perfect love has continued, as far as I know, to the present day, through several marriages and innumerable affairs.

12. Tenseness and inability to relax. Because they constantly worry about whether they are doing the right or wrong things, disturbed people cannot very well relax. As a result, they suffer from a physical tension which evidences itself in muscular ailments, poor coordination, the inability to sit still, and so on.

Sometimes the result is psychological tension during which disturbed people report that they feel emotionally numb, or are afraid of something but don't even know what they fear. A certain amount of effort is essential to normal living; otherwise we would not succeed in doing

anything or getting anywhere. But the neurotic experiences unnecessary effort: strain which he himself causes by his groundless fears, his irrational worries about what others think.

13. Inertia and lack of direction. Many neurotics lack any definite goals in life. They are, in fact, on a sort of sitdown strike against life, since they believe that the world owes them a living and that they should not be required to work hard or discipline themselves to get the things they want.

Deep in their hearts, they do want to strive for something, to realize some goal. But as soon as they meet difficulties in their striving, they give up and withdraw from competition. Once they give up, getting back to work becomes even harder because their inertia makes them poor in accomplishments, which in turn leads to hopelessness and more inertia.

14. Escapism and avoidance of responsibility. Instead of facing their difficulties, emotionally disturbed individuals frequently see a problem and run. They refuse to discipline themselves or to assume the normal responsibilities of life. Often they attempt to live as perpetual children, and if they marry, they live as child-wives and child-husbands. If they can literally run away from difficulties, they do so: to a new home, a new job, a new marriage, a new wardrobe. When they cannot actually run, they find numerous ways of refusing to assume life's usual duties and obligations.

15. Self-abasement and self-punishment. As if all their other neurotic traits were not bad enough, some disturbed persons literally try to punish themselves for their assumed sins—including the sin of being neurotic. Starting with perfectionist assumptions that make them feel that they are wicked or inferior, these neurotics live up to their own false picture of themselves by doing things they think they should not do or by not doing things they think they should.

Then, noting their own weakness or "badness," they punish themselves further by doing something weaker or meaner. This leads them to have still less self-confidence, thereby keeping the ball rolling steadily downhill.

• • •

The basic causes of neurosis are not the unfortunate happenings, dangers, or frustrations that often beset our lives; they are, rather, our own unrealistic views about the way things are and the way they supposedly should or must be.

When an individual experiences exceptional tension, despair, or anxiety, or when he has unusually rigid defenses and has to resort to paranoid thinking, extreme inertia, or other unusual escapes from reality, he is psychotic rather than neurotic. Psychotics are extremely disturbed persons who almost always need intensive professional treatment.

But the great majority of troubled individuals are in the neurotic rather than the psychotic range. And, if these neurotics are understood and reacted to favorably, most of them can be helped considerably.

From Colombia's ancient mines come . . .

EMERALDS--
Treasures of the Andes

by Ted Morello

Condensed from Nature Magazine

SINCE Cleopatra's jewelers carved her likeness on the green crystals of Nubia, emeralds have hypnotized gem lovers the world over. Nero is said to have watched the barbaric Colosseum games through an emerald monocle. Ivan the Terrible compared the stone to the rainbow. Empress Josephine, forsaken by Napoleon, wore emeralds for a portrait "to represent the undying freshness of my grief."

But not even the Egyptian queen ever commanded gem treasures of the shade, size and flawlessness that flow from the deposits of Colombia, today's only importance source of fine emeralds. For 400 years the Muzo and Chivor emerald mines have poured matchless crystals into the world's royal households, museums and private collections.

Today, the outpourings of these mines, and a few smaller deposits in the same region, amount to a world monopoly, jealously guarded by the Colombian government through its bank, the Banco de la Republica.

Colombian production is distinctive in gem size and, most important, in quality. Size alone is of little importance in determining the value of a gem. The Patricia emerald, for example, is a giant 632-carat Chivor stone currently in the American Museum of Natural History in New

York. As a specimen of the mineral's crystallization, it is magnificent. But because of cracks and minute foreign bodies in the mineral, the imperfections most common in the emerald, it is of relatively little value as a gem stone.

An even larger but comparatively worthless emerald was discovered recently in northern Transvaal. News reports from South Africa originally placed estimates of the 24,000-carat stone's value as high as $15 million. When it arrived in New York, Harry Winston, among the country's leading appraisers, took one look and lost interest.

"It probably is worth a few thousand dollars," he conceded. "But mainly, it would make a fine doorstop."

Emeralds are mined sporadically in regions outside Colombia: South Africa, Brazil, the Urals, the Tyrols, India. Although these areas have contributed some first-rate gems, the yield is more usually marred by an unevenness of color, foreign particles, or a network of tiny cracks.

To the expert, an emerald—rivaled only by the gem ruby as the most precious of jewels—is judged by its transparency, its freedom from flaws, its evenness of color and its deep, intense shade of green. Against these standards Colombia's output, both in size and percentage of fine stones to total production, is undisputably the finest in the world.

A flawless stone—one that shows no imperfection under 10-power magnification—is rare, and regularly commands three to four times the price of a comparable diamond. Dewey Sullivan, a Fifth Avenue jeweler in New York, recalls that a 3-carat emerald sold for $18,000—"and during the depression, at that." And Francis P. Pace, president of Chivor Emerald Mines, Inc., which owns Quesada's old workings, tells of a 13-carat stone that brought $10,000 a carat!

In the days of the Spanish Conquest, legend had it that emeralds were the gallstones of dragons, or that they came from the bellies of green boas. Garcillasso de la Vega, a Conquest chronicler, theorized that the emerald grew, potatolike, in the ground, "ripening" from a colorless crystal to green upon exposure to the sun. One specimen found in Peru, he said, was partly colorless and partly green, like a half-ripe fruit.

Actually, emerald is a variety of the mineral beryl—a beryllium-aluminum silicate—and owes its color to chromium, an impurity present in varying amounts during formation, but not essential to the mineral itself. As beryl, emerald is chemically identical with other stones that rank as merely semi-precious—the bluish-green aquamarine, red-tinted morganite, yellowish golden beryl and colorless goshenite.

Emeralds occurring in the same deposit may range from almost opaque to those with only the merest tint of green, depending on the amount of chromium present at the time of crystallization. On this basis, one can forgive Garcilasso his "ripening" postulate.

Explaining emerald formation in

less romantic terms than the old chronicler's, Dr. Rafael A. Dominguez, chief of the Colombian Ministry of Mines' fiscal section, says:

"The mineralizing solution was formed at temperatures below 575 degrees Centigrade. Pressure forced the solution through faults and fractures of the sedimentary strata. The solution's gaseous elements reached the upper veins of the stratum, crystallizing into emerald and associated minerals under special conditions of time, temperature and pressure."

Considering the continent-long extent of the Andes, it is a major geological quirk that these "special conditions" should have prevailed only in the compact Chivor-Muzo region. Yet, intensive prospecting has failed to turn up deposits elsewhere in the mountain chain.

Chivor lies 100 miles northeast of Bogota, a chilly 9,000 feet high amid gaping canyons and towering peaks. The Muzo mines, some 65 miles north of the capital, are at the 2,600-foot level in the stifling tropical forests on the Carare-Minero River.

Production methods today are essentially the same as those employed by the Chibcha Indians, with refinements introduced by the Spaniards. Tunneling, the older of the two mining methods, has been practiced intermittently. However, step-cutting, or terracing, is favored as being cheaper and more efficient; for emeralds occur so irregularly in a formation that drifts are likely to pass within inches of a rich pocket without indicating its presence.

In step-cutting, a hillside first is stripped of forest. Indian workers attack the slope with hoes and crowbars, carving into the hillside steps from 55 to 165 yards long, 17 to 22 yards wide, and a yard deep, depending on the topography and terrain. The debris is spilled to the foot of the terrace, to be washed away by floods released periodically from a reservoir above. The miners cut back the steps, probing for crystals as they go, until the emerald-bearing layer has been completely stripped away.

The emeralds themselves occur between thin layers of soft, black shale and shaly limestone that lie atop one another like warped pancakes, 2 to 5 centimeters thick. These layers are crossed at random by veins of calcite and accessory minerals, including emerald. Such veins — the emerald pockets, or shoots — range from less than a centimeter to more than 60 centimeters in thickness, depending on the degree to which the veins are flexed, contorted or ruptured. Each pocket may yield from a few to several hundred emeralds, or varying size and quality.

Colombia's production of emeralds does not consist entirely of gem stones. Mr. Sullivan relates that, as a buyer, he purchased 300,000 carats of rough emeralds in 1946 from the Banco de la Republica. The entire lot yielded fewer than 250 carats of really fine stones of three carats or more. Large, superfine stones are so rare, and in such demand, that they seldom are offered across the counter. Instead, they are sold with the trade's traditional secrecy regarding

price and purchaser, in direct negotiations with private collectors.

The question of genuine versus imitation emeralds is one of long standing. In antiquity, the word for emerald covered virtually any transparent green stone, thus accounting for some incredible tales. The 2nd-century Greek writer Lucian, for example, asserted in his *True History* that the walls of the Gem City of the Island of the Blessed were of emerald. And Herodotus tells of the emerald pillars of Hercules's temple.

Present-day concern with imitations is not always so honest. José Orjuela, a Colombian familiar with the illicit emerald trade, once warned an American friend in Bogota: "A tourist should know emeralds well before attempting to buy contraband stones. Many convincing 'gems' offered here are paste imitations made in the United States."

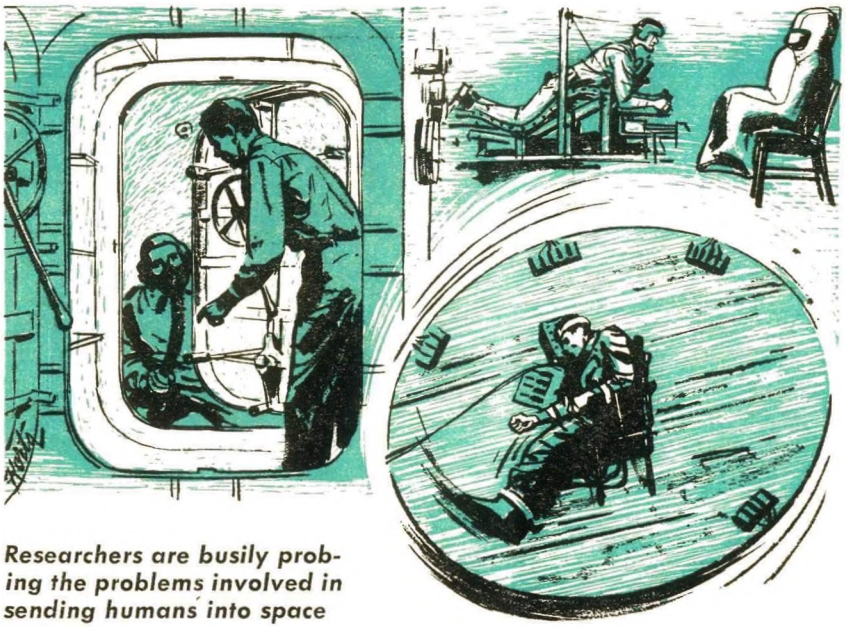
Chemists have long sought nature's secret of the emerald. The most successful is Carroll F. Chatham, a San Francisco research chemist, who has synthesized emeralds that are chemically identical with the natural stone. By a process so secret that he refuses to have it patented, Chatham "grows" in an aqueous solution something more than 60,000 carats a year. Of the total, roughly half are of low quality, 40 percent are of medium grade and the remainder are fine stones, retailing at between $90 and $120 a carat.

However, the largest flawless stones weigh no more than 2 carats. Among jewelers anything below 3 carats is considered small. Chatham stones are almost indistinguishable from natural emeralds. But heated to incandescence a Chatham will not crack; a natural emerald will.

Despite the unanimity of opinion concerning Colombian emerald excellence, an old and continuing debate surrounds the relative merits of Muzo and Chivor gems. Whatever difference may exist appears to center about the relative perfection of color and the degree of "fire." Muzo claims to excel in the first attribute, and Chivor in the second.

The argument is largely meaningless. So far as color is concerned, once a degree of excellence is attained the "perfection" of a stone's shade depends less on the gem than on the observer's taste. "Fire," conveying what in a diamond is called "brilliance," is likewise an unsubstantial factor, since emerald is mineralogically weakly refractive, and hence almost wholly lacking in sparkle.

It is the color, rather than the fire, that makes the emerald so desirable, and the finer crystals are fashioned for their mountings by the method known to the gem-cutting trade as the step, trap or emerald cut, whereby the shining facets make long inclined planes around the sides of the stone. This type of cut, adapted not only to the emerald but to other stones of deep or rich colors, dates back to early times, and the gem cutters of antiquity were well aware of its merits. While a diamond fancier is hypnotized by refracted light accentuated by multifacet cutting, an emerald lover looks *into* the cool, restful green of his favorite stone.



Researchers are busily probing the problems involved in sending humans into space

TESTING TOMORROW'S SPACE PIONEERS

by William G. Smith

Condensed from The Wall Street Journal

ANY DAY NOW, a blond, 23-year-old airman from the Bronx, N. Y., will angle his 6-foot, 180-pound frame into a round, steel contraption and "ascend into outer space" for a week.

His craft won't be spacious; it measures about 4 feet across. Neither will it be sleek; it looks, in fact, much like an ordinary coal furnace. And it won't ever get off the ground, for it hunches unmovable in the basement of a laboratory at the Air Force School of Aviation Medicine at Randolph Field near San Antonio, Tex.

Yet many of the conditions that man might encounter in a craft rocketing through space can be simulated in this experimental space cabin. Though small, it carries its own oxygen supply, air circulation system and various control instruments.

The reactions—physical and mental — of Airman First-Class Donald G. Farrell to varying oxygen and temperature conditions and to the

The Wall Street Journal (Dec. 4, '57), 44 Broad St., New York, N. Y.

isolation will be continuously checked during his week-long confinement—slated to be the longest yet attempted. The record stay in the cabin to date is 26 hours.

Airman Farrell's grueling test will be merely a routine exercise in space medicine research—a relatively new science that seeks to determine how much punishment earthbound man can withstand if and when ships are made to blast him into space and return him safely. Aircraft manufacturers must know the bounds of bodily tolerance before they can build living quarters for men in space vehicles.

At this point, the Air Force, which is carrying on much of the nation's space medicine research, isn't saying whether it has any specific project under way to hustle humans into space. But a growing number of space scientists, including some in the military services, are predicting manned spaceflights by as early as 1962.

Before any ship with humans aboard can be blasted into space, much still has to be learned about rocket construction techniques as well as conditions beyond the earth's atmosphere.

Much of the Air Force's activity in space rocketry is, of necessity, shrouded in secrecy. But visits with researchers at the school at Randolph Field and at Holloman Air Force Base at Alamogordo, N. Mex., underscore these points:

The Air Force believes it has learned enough about man's requirements for space survival to begin huddling with engineers on the actual design of spacecraft. Preliminary consultations have begun.

Money for space medicine research, limited up to now, is likely to be increased in the months ahead — portending stepped-up research activity in this field.

There's no precise line, of course, where the earth's atmosphere ends and "outer space" begins. Most authorities agree, however, that technically the last traces of gas in the earth's atmosphere extend upward to about 190 miles. As far as is known, only Laika, the dog in Russia's Sputnik II, has gone beyond the earth's atmosphere; U. S. researchers have sent up other animals in balloons as high as 15 miles or so and brought them back alive. And last August, Air Force Maj. David Simons reached a record height of nearly 20 miles in a balloon, above 99 percent of the earth's atmosphere.

At such heights, of course, problems for human beings multiply. Dangers include cosmic radiation, which scientists say might induce such slow-starting diseases as leukemia and cancer; lack of oxygen; extreme heat and cold; extreme outward pressures on the vehicle because of the space vacuum; intense feelings of loneliness; and the curious state of weightlessness, which may have important psychological effects.

Much space medical investigation must be done —probably a large part of it with animals in balloons and rockets — before the first American ever reaches outer space. Humans will be subjected to rigorous indoc-

trination on the ground, testing all sorts of space survival equipment and spending long periods of the time under simulated spaceflight conditions.

Initial spaceflights by animals from the U. S. probably will be short, perhaps only a few hours or days, and probably would be in earth-circling satellites. The main purpose would be to take readings by radio signals of such bodily functions as pulse, breathing, brain and heart activity and digestion—similar to those apparently taken by the Russians with Laika.

The first human flights around the earth probably will be only a few hours' long to test body reactions, scientists indicate. The first American to orbit in space is expected to be a medical doctor. He may also be a pilot. This, experts explain, would be to give him added assurance of being able to guide his vehicle back to earth without mishap—assuming, of course, it would require human control.

Later, researchers say, ships would be designed to carry crews of three or more. After sufficient data is gathered on satellite travel, scientists would then tackle the more challenging job of travel to other planets.

In the meantime, researchers both in and out of government are busily probing the practical problems involved in sending humans into space. A tour of facilities at Randolph Field and Holloman, and talks with top industry and Air Force officials, shed light on the nature of these activities.

At Randolph Field, about 40 Air Force men, some of them pilots, have volunteered in the past year to stay cooped up inside the School of Aviation Medicine's space cabin for periods ranging from 30 minutes to 26 hours, reports Lt. Col. George Steinkamp, head of the school's department of space medicine, set up in 1947.

Airman Farrell is not one of the regular volunteers; he works as an accountant in the base comptroller's office. But he had been spending spare time around the school. When he heard that officials were looking for volunteers, he volunteered. The young man possesses no unusual physical qualifications, Air Force people say.

The space cabin is located in a basement room crammed with four other gleaming, silver-painted trainers. Two are long, cylindrically-shaped pressure chambers, not connected with space experiments, where pilots and flight surgeons are "shot" to simulated high altitudes to practice use of oxygen breathing equipment. Nearby are two smaller ones designed for studying altitude's effects on dogs and other animals.

In an adjoining room is a third animal trainer. Peek through a porthole and you see two dogs in cages, looking none the worse for wear at an "altitude" of about 3.5 miles. "They've been in there two weeks," explains a technician. "We're trying to find out what happens at that altitude to the formation of red blood cells."

Next to the sealed space cabin, Dr. Steinkamp relates: "Most of our

space tests have been short in duration. We're trying to simulate many of the emergencies that might occur inside a cabin in space. For instance, we might fill the cabin with 30 percent or 40 percent oxygen — way above what usually is in the atmosphere (normal content on the ground is around 21 percent)—and see what happens to a man's pulse or respiration."

Electrodes, including those of an electrocardiograph, are attached to a subject's ankles and wrists to measure pulse beat, frequency and depth of breathing, heart activity and the like. Temperature at about a half dozen places in the cabin is recorded. Technicians also keep track of such things as humidity and carbon dioxide content.

• The final test of science is not whether its accomplishments add to our comfort, knowledge and power, but whether it adds to our dignity as men, our sense of truth and beauty. It is a test science cannot pass alone and unaided.—David Sarnoff

For Airman Farrell's test, certain accommodations not possible in real flight will be made. Special food, excluding a lot of bulk, will be passed to him from the outside; body wastes likewise will be passed out through containers. He will not be able to move about much; his "rest" will come from propping his feet up on a kind of rack.

To emphasize the need for alertness, spacemen in the trainer are required to solve "problems" on an electronic device resembling a large short-wave radio. On the face of this 30-inch-long steel cabinet — which will sit right in front of trainees in their cramped quarters—are a small radar screen, several dials registering air speed, rate of climb and the like, and a series of lights and switches. Pilots will be briefed about what to do if certain lights come on. This will indicate a specific "emergency" or malfunction, such as loss of oxygen. They'll also "navigate" by means of the radar and flight charts.

"We plan to correlate man's ability to solve these problems with readings on his body functions and conditions inside the cabin," says Dr. Steinkamp.

"We'll do such things as boosting oxygen content above normal—or putting temperatures or humidity outside of comfort limits—to see what they do to his problem-solving, or ability to make fast decisions. So far, we've found that the temperature range for maximum efficiency is between 60 and 90 degrees, while humidity should stay from 40 percent to 60 percent."

Similar experiments on human and equipment tolerances under space conditions are going on in private industry, too, researchers note. For example, North American Aviation, Inc., sometime this year plans to test-fly the X-15, a rocket-propelled high-altitude research plane said unofficially to be capable of a maximum altitude of 100 miles and a top speed of 4,000 miles an hour.

Scott Crossfield, North American pilot who will test-fly the craft, already is undergoing stiff physical

conditioning. For instance, he's been whirled at extremely high speeds in a centrifuge to see how violent a movement he can take before he blacks out.

In Beverly Hills, Calif., at Litton Industries' high vacuum laboratory, Dr. Sigfried Hansen, the company's technical director of research, recently spent 4-1/2 hours at a simulated altitude of 90 miles in a space test chamber.

At the Aero-Medical Field Laboratory at Holloman, which squats in a desert between the Sacramento and San Andres Mountains about 85 miles north of El Paso and 40 miles southeast of the site of the first A-bomb blast in 1945, more than 70 plastic balloons bearing monkeys, guinea pigs and mice have been sent to heights of up to 25 miles. Many of the flights have been to test for cosmic radiation.

The lab sits inside a barbed-wire fence in an isolated area in the northern part of the sprawling base. The first of four neat, yellow wooden buildings houses a workshop. Inside, enlisted men in green fatigues tinker with radios, tape recorders and other intricate gear they pack, along with animals, inside plastic balloon gondolas which are about 3 feet in diameter and are shaped like salad bowls. Stroll around and you hear the barking of chimpanzees or the chattering of monkeys. Outside another building, two black bears in cages calmly lick their paws. All the animals are used for one experiment or another.

In one radiation experiment, for example, crews from Holloman sent two Java monkeys to over 17 miles in a balloon for 62 hours from northern Michigan (cosmic ray "hits" are more intense in northern latitudes).

Electronic ground controls ripped a panel from the balloon and released a parachute that brought the monkeys, a small tape recorder and other equipment, back to earth.

After a series of physical examinations and behavior tests, the monkeys showed no ill effects from cosmic rays, according to Maj. Simons, chief of the laboratory's space biology branch.

The only harm from cosmic radiation observed thus far has been a graying of the hair of some mice and rats, reports Dr. Simons, a tall, 35-year-old, scholarly-looking man.

Colonel John Stapp, head of the field laboratory at Holloman, reports he intends to send an animal, probably a rhesus monkey, to nearly 80 miles in a balloon for possibly a week, to get one more experience with cosmic radiation.

Doctors Stapp and Simons, both physicians, already have gained some measure of fame as space medicine pioneers. Dr. Stapp rode a rocket-propelled sled to a speed of 632 mph three years ago. He was testing how much strain a man can stand when accelerating or decelerating to or from high speeds—something a space flier would experience. Dr. Simons was crammed into a sealed capsule about the size of a telephone booth when he rode his balloon to a record height and remained aloft over 32 hours.

One vitally important outer space phenomenon the balloon experiment didn't permit Maj. Simons to experience was weightlessness.

This occurs when the centrifugal force of a satellite spinning around the earth offsets the earth's gravitational pull — making anyone inside seem to weigh nothing. It's roughly akin to the sensation you get momentarily on a roller-coaster as it whizzes down one hill and up another.

"The fact the Russian dog seemed to survive weightlessness with few apparent ill effects is encouraging," remarks Dr. Stapp. "It has confirmed a belief we already had that weightlessness does no appreciable harm to the body." But, concede other Air Force men, humans still need to be subjected to this sensation for longer periods than previously to study the possible side effects it may have.

At Randolph Field, more than 2,000 separate states of weightlessness have been produced in the last year or so on around 100 volunteer subjects—many of them Air Force enlisted men—by flying an F-94 jet fighter in a roller-coaster-like maneuver. The weightless state occurs for around 30 or 40 seconds at the top or bottom of what scientists call a "parabolic arc."

Major Herbert Stallings, a boyish, athletically-built pilot who occasionally likes to joke about being a "space pilot," has been at the controls on most of the tests.

"Personally, I like the feeling," he says. "It's a lot like the brief but pleasant sensation you get when you drive along a highway and suddenly hit a dip in the road."

Essentially, the aim of space medicine is to aid aircraft makers in creating, as closely as possible, the same atmospheric conditions for humans in space that prevail on the ground. Researchers have found that to do this would, first of all, involve use of a tightly sealed cabin. This would be far different from the pressurized cabin in present commercial airliners, where outside air is compressed and pumped inside to simulate lower altitudes at which breathing is easier.

It's been determined that beginning as low as about 15 miles, the air is so thin that the equipment to compress it would be too expensive and cumbersome to be practical. And in outer space, of course, there would be practically no air to compress.

But the sealed cabin poses problems, too. For one thing, it would require its own supply of oxygen and other gases, plus equipment to regulate their flow.

It also would need a system to get rid of the carbon dioxide, constantly exhaled by humans, to avoid death by suffocation. In his balloon, Dr. Simons did this chemically by using a block of soda lime, which absorbs carbon dioxide out of the air.

He says this system might be practical on short flights. But for extended trips of perhaps several weeks, a system to continually remove the carbon dioxide and remanufacture oxygen may be needed to avoid carrying bulky supplies of oxygen in tanks or bottles.

One solution, researchers note,

might be to carry aloft some kind of plant which in its normal growth cycle takes in carbon dioxide and gives off oxygen. The Air Force is now experimenting with algae, a fresh water plant which "might furnish the means for an ideal situation —man in space with earth plant life right with him," according to Dr. Hubertus Strughold, space medicine consultant for the School of Aviation Medicine. The algae might also serve as a food for spacefliers.

To get an idea of how rugged spaceflight training may prove to be, listen to what Dr. Simons did to prepare himself for his balloon trip to 20 miles up last summer. First he spent two 24-hour periods inside the capsule on the ground at Holloman, and another 24-hour stretch while the capsule was inside a pressure chamber at Wright-Patterson Field at Dayton, Ohio — where the Air Force develops such equipment as pressure suits.

In the chamber, Dr. Simons was raised to a simulated height of about 16 miles. Later he made a practice parachute jump from about 2 miles and underwent 20 hours of training to qualify as a balloon pilot.

Doctor Simons leans back in his chair at the Holloman lab and closes his eyes tightly.

"During those long hours of training in the capsule, I tried to overcome fatigue and agitation at being cooped up in an enclosed place by constantly monitoring my instruments—something I knew I'd have to do on the actual flight. Fatigue naturally was a problem, but it's something a man will just have to adjust himself to."

He continues: "On the flight, I often had to force myself to think—it was a tremendous effort. I took frequent cat naps. One thing I had to fight was what you might call a loss of initiative, resulting mainly from tiredness and a feeling of complete isolation from earth."

The experts emphasize that human space travel depends on development of missiles capable of being slowed down so they can re-enter the earth's atmosphere. The slowdown is necessary because humans would not be able to withstand the immense heat and impact when the ship hit the denser atmosphere.

The heat and impact problems, though important, are not as crucial in an unmanned missile. But even though these uncertainties — and many others, too — hang over their heads, most space medicine men talk optimistically about human spaceflight in the not-too-distant future.

"Much of the basic research has been done," declares Col. Stapp. "Now," he says, "it's time to begin applying it."

A LANGUAGE must grow or die. Shakespeare managed to write with a vocabulary of 15,000 words. Today the language of England, America and other English-speaking lands embraces 600,000 words, and is growing daily.

—*Walter Monfried in The Milwaukee Journal*

An expert gives gardeners some timely tips on the use of . . .

GIBBERELLIN—MIRACLE PLANT STIMULATOR

by Samuel Johnson

Condensed from The Flower Grower

GERANIUMS that bloom earlier with larger flowers that last longer, seeds that pop out of the ground faster, delphiniums that bloom the first year like annuals—all these can be yours when you use the new plant-growth stimulant, gibberellin.

African violets treated with gibberellin [gibberellic acid, see SCIENCE DIGEST, April, '57] display their flowers on longer stems. Spray every few days until results are noticed; as soon as the plant responds, cease application.

On young petunia plants two or three applications make them grow faster and bloom earlier. Since gibberellin is no substitute for fertilizer, plants should be given generous applications of fertilizer and water.

Speeding seed germination is one of the most important uses for gibberellin. The difference is most noticeable when seeds are planted during cold, wet weather.

For instance, peas often encounter unfavorable germination conditions when planted in late winter or early spring. But treat them with gibberellin before planting and they come up in much less time. A light but thorough coverage from an aerosol type of sprayer is a convenient method of application. A thin film of gibberellin is left on the surface of each seed.

Research and tests to date show that the material is compatible with commonly used insecticides and fungicides often applied to protect the seeds from diseases.

In addition to increasing speed of germination, gibberellin causes most seedlings to grow taller. This difference in seedling height is apparent

HARMLESS TO HUMANS

THE FARMER who may use gibberellic acid to speed up plant growth and the consumer who eats gibberellic acid-treated foods need not worry about being poisoned by the substance.

A team of scientists at the Merck Institute for Therapeutic Research, West Point, Pa., has found that gibberellic acid is "relatively harmless" when administered orally, by injection, by inhalation or when applied to a part of the body such as the eye. The scientists experimented with white rats, rabbits and cultures of rhesus monkey cells.

Considering that the growth-promoting substance is so powerful it may be used successfully in amounts that leave no residue on plants, the scientists find its low toxicity remarkable.

Harold M. Peck, Samuel E. McKinney, Alfred Tytell and Bruce B. Byham reported their research in *Science*.

for several weeks following emergence. Earlier germination helps avoid the adverse effect of soil crusting; and taller early growth permits earlier weeding.

Soaking bulbs in a solution of gibberellin substitutes for the chilling period so that you can dig bulbs, treat them, and replant them all at one time—a boon to gardeners in the warmer climates. In some cases this means you can pick flowers months ahead of time.

This is in contrast to the normal practice of digging the bulbs, storing them at cold temperatures and replanting in spring. Most bulbs initiate flower buds in the late summer, but further development of the flower depends on an adequate chilling period, without which the flower stalk will not elongate when spring arrives.

Treated delphiniums and foxgloves bloom the first season; they ordinarily require two seasons. This transformation to an annual flowering habit is a highly desirable characteristic. Canterbury bell is another example of a biennial that will flower the first season when treated at weekly intervals until the flower stalks are well established.

The life of some cut flowers may be extended several days if a small amount of gibberellin is added to the water in which the flower is placed. A 1- or 2-second burst from an aerosol bomb into a medium-sized flower container should be sufficient. If results are not apparent, increase the dosage gradually on each succeeding bouquet until a difference can be detected. It is well to have an untreated bouquet available for comparison.

In summary, look to gibberellin to stimulate new growth or the rate of growth. The material accelerates blooming and improves the size and quality of many flowers. Susceptible plants usually respond within ten days. Other less susceptible plants require regular weekly applications. Some plants do not seem to respond at all. When you don't see any response within a couple of weeks, repeat the application.

Since a number of different formulations are available, follow the directions on the container. The use

SAMUEL JOHNSON is an assistant professor of plant physiology at Texas Agricultural and Mechanical College and has been active in research on gibberellin.

of the gibberellin aerosol bomb has been discussed in this article. Gibberellin is also available in other forms, including tablets and powders. The strength of the formulations in aerosols and tablets may vary among brands. When used as directed on the package the material is considered non-toxic and leaves no hazardous residue.

These are but some of the reasons why many scientists say the development of gibberellin is the most important single chemical discovery of the past quarter century. Try it yourself and see.

Range of Radio Telescopes May Be Extended Ten Times

AN AMPLIFIER which may extend the range of radio telescopes ten times farther out among the galaxies has been developed in the Gordon McKay Laboratory of Applied Science at Harvard.

This device, which may enable man to "hear" the radiation from hydrogen clouds in galaxies beyond the range of any present instruments, was recently operated in a laboratory test. Scientists believe that the device will allow detection of signals 1/1,000th as strong as can be observed now.

Its potential applications include certain radar systems as well as the research field of radio astronomy.

The "three-level solid state maser" (for Microwave Amplification by Stimulated Emission of Radiation) was developed by a Harvard research team.

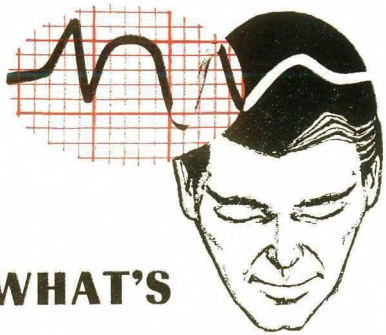
The new device, it is predicted, would enable radio telescopes to reach out into the universe as far as, or farther than, the best optical instruments. A maser-equipped telescope should provide a test of cosmological theories (such as the theory of the expanding universe) "better than any other present means," and should be able to confirm or deny the existence of hydrogen gas between the galaxies, now only suspected.

The maser is an ingenious device which provides amplification by redistributing the magnetic moments of the electrons inside a crystal. The Harvard maser is not the first one, but it is the first to run successfully in the 21-centimeter wavelength band—the frequency of emission from interstellar hydrogen.

The term maser was coined in 1954 by Columbia University Prof. C. H. Townes who first proposed and successfully constructed amplifiers of this type, using a gas instead of a crystal for an operating medium.

The heart of Harvard's maser is a single crystal of potassium cobalticyanide, with an intentionally introduced impurity of 1/2 of 1 percent of potassium chromicyanide. The crystal, about the size of the last joint of a man's thumb, is kept by a bath of liquid helium at 2° Kelvin, a temperature only slightly above absolute zero.

Electrons of the impurity in three discrete energy levels are used. Amplification is gained by shifting electrons from level to level, within the crystal.



WHAT'S ON YOUR MIND?

U.S. AND U.S.S.R. POPULATION GROWING AT THE SAME RATE

The populations of both the United States and the Soviet Union are apparently growing at the same steady rate, with Russia expected to retain its present numbers lead, the Population Reference Bureau says.

No one knows for sure how many Soviet citizens there are, not even the Kremlin. For this reason, the experts' eyes will be on the Russian census scheduled to begin in January, 1959 — the first Soviet nose-counting in 20 years.

Based on a recent official Soviet estimate, the Russian population of today is around 205 million; the U. S. population is about 172 million.

A generation ago, birth rate trends in the U.S.S.R. and the U.S. were in opposite directions. In 1926, the Russian birth rate stood at nearly twice that of the U. S. It has since declined to the point, in 1950, where it was only slightly higher than the U. S. rate.

From 1950 through 1955, the rate of natural increase — the difference between the birth rate and the death rate—has been slightly higher for the U.S.S.R. than for the U.S.

The bureau's comparison of the two nations' death rates shows fairly parallel downward trends in the post-war years due to medical advances. That Russia's death rate in 1955 was lower than that of the U.S. can be attributed to the relatively younger population of the Soviet Union.

The Russian death rate may actually be greater than the figure given. In view of the relatively low level of living in many parts of the U.S.S.R., western population experts consider the Russian figure remarkable but not impossible.

JOB CHANGES FOR OLDER WORKER CAN CAUSE MENTAL ILLNESS

Job changes, or even promotions, for some older employees during the latter part of their careers may touch off serious cases of mental illness.

Reports on 14 such cases were presented at a meeting of the New York division of the American Psychiatric Association by Dr. Eugene T. Hupalowsky and Dr. Alan A. McLean.

The emotional reaction occurred in these men, whose average age was 52 years, when an occupational change was made at a time that they were adjusting to some external stress or physical illness.

Included in the study were men

from seven different companies. They were 41 to 64 years old and they averaged 27 years in the employment of their companies. All had been severely incapacitated by their mental illness and all had experienced a job change.

There was a wide range of employment, according to the *New York Times*. There were four engineers, five skilled workmen, an architect, a bank clerk and three executives.

Most of the men appeared to have "pronounced feelings of dependency" toward their company, the study found. Some had developed prolonged and strong relationships with members of management and had looked upon them as "good father figures."

The occupational changes that triggered emotional reaction included retirement without an expected pre-retirement promotion and promotion to a position of higher responsibility. Four of the reactions were attributed to promotions and five to a demotion to a job of reduced status or income. A sudden change in supervision on the same job apparently set off two incidents.

MEN MORE HONEST THAN WOMEN SAY FINNISH RESEARCHERS

Men are more honest than women, if only slightly, Finnish researchers have decided after a five-year study of Finland's population.

In the experiment, customers who made purchases in various stores throughout the country were given too much change, the overpayments ranging from about 25 cents to $1.50. On the average, 58.4 percent returned this extra money.

The men had the higher percentage of honesty: almost 61 percent of them returned the money; nearly 56 percent of the women did so.

HOSPITAL PERSONNEL MOST CRITICAL OF HOSPITAL CARE

People who feel they haven't been well treated during a stay in the hospital are not nearly so critical of hospital practices as the people who work in the hospitals.

In a survey made by the U. S. Public Health Service in cooperation with the American Hospital Association, hospital personnel reported three to four times as many unfilled patient needs as the patients themselves noticed. The survey covered 9,000 patients and 10,000 hospital administrators, doctors and nursing personnel in 60 hospitals.

Both the patients and the personnel complained about noise in rooms and corridors, cold food, the habit of awakening patients too early, and poor room ventilation. Hospital personnel reported, too, that bookwork, housekeeping and feeding activities prevented them from spending enough time with patients. The average nurse, the survey reveals, spends 18 minutes with each patient during the day shift and 8 minutes during the night shift. →

WHO RULES THE JURY?

You have been injured in a two-car collision. Now you are in court, facing a jury, seeking money to pay your medical bills. Whom on the jury must you convince of the justness of your cause?

All the jurors, of course, but especially those who in private life are business executives and professional men. It's these men who will have much influence in determining the jury's verdict, according to research conducted by Fred L. Strodtbeck, Rita M. James and Charles Hawkins, of the University of Chicago.

Reporting in the *American Sociological Review,* the researchers say they studied 49 juries, organized from the regular jury pools of Chicago and St. Louis courts. In a mock court setting the jurors heard a recorded trial, like the one described above, then retired to deliberate while the researchers listened in.

In various ways the executives and professional men, called the "proprietor" class by the researchers, showed they dominated other members of the jury (classified as clerical employees, skilled workers and semi-skilled or unskilled workers).

In 18 of the 49 juries, the foreman selected was of the "proprietor" class, although this was far more than could be expected from the number of jurors in this classification. They also contributed more to the discussion of the case. In all occupational classifications, the men out-talked the women.

Significantly, the "proprietor" class's pre-deliberation idea of what the verdict should be was often in agreement with the jury's final decision. Other occupational classes more often were in pre-deliberation disagreement with the jury's eventual verdict.

In pre-deliberation questioning, members of these other occupational groups also showed great respect for "proprietor" class jurors. Asked what occupational makeup they would like in juries if they or some member of their family were on trial, members of 28 juries most often picked the "proprietor" class. Members of 20 other juries, however, had a lower estimation of executives and professional men after jury deliberations.

The researchers believe that "proprietor" class jurors are able to influence their fellow members because the skills they use in their occupations become potent forces in the workings of the jury.

"PICTURE" OF LEARNING SEEN IN BRAIN WAVES

Electrical impulses from the brain waves, for the first time, have drawn a "picture" of the learning process, reports *Science Service.*

These developments in scientific "mind reading" have occurred in brain experiments being carried out by Drs. Keith Killam and E. Roy John of the University of California

at Los Angeles School of Medicine.

Cats were taught by a warning signal, either a flashing light or a clicker, to move so as to avoid an electric shock.

This learning was accompanied by changes in brain waves emanating from certain brain areas. The waves were carried through permanent electrodes in the cat's head and recorded by an EEG (electroencephalograph) machine. A characteristic wave pattern preceded certain of the cat's moves.

Tranquilizers administered to the animals made them forget what they had learned about the light-clicker-shock relationship. Tranquilizers also erased the "trained" patterns of brain waves. They were replaced by patterns characteristic of untrained cats.

As these drug effects wore off the cats again remembered what they had learned about the warning signal. "Trained" electrical patterns also reappeared on the recordings.

LOOK OUT FOR INFECTIOUS KIDS!

Children introduce twice as many illnesses as the parents into the family, Dr. John H. Dingle, professor of preventive medicine, Western Reserve University medical school, reports.

Doctor Dingle based his statement on a study of 436 persons in 85 Cleveland families for 9-1/2 years.

The average person, he said, contracts 9.24 illnesses a year, but he pointed out that this rather high average is weighted by the high number of illnesses of young children.

More than 60 percent of the illnesses were respiratory, and 95.4 percent of these were the common cold or influenza, he said. Sixteen percent of the illnesses were attributed to gastrointestinal disturbances, notes *Scope Weekly*, while communicable diseases of childhood and noninfectious diseases accounted for 20 percent.

TODAY'S WORKER BETTER SCHOOLED THAN HIS COUNTERPART IN 1940

The average American worker has completed 11.8 years of schooling, according to a survey conducted in 1956, as compared with his less educated counterpart of 1940 who had only 9.3 years.

Behind this increase in education, says the U. S. Census Bureau (which made both studies), is the growing number of workers with a college education. In 1940 the bureau found that 13.4 percent had some college training and that 6.4 percent had been graduated. But in the 1956 survey, figures for these two groups rose to 18 percent and 9 percent.

The general level of workers' education has also been raised, however. The number of workers whose schooling stopped after their first eight years dropped from 39.4 percent in 1940 to 26.2 percent in 1956.

Women workers showed a higher level of education than the men in

the 1956 study: the average woman worker had completed 12.1 years of school; the average man, 11.3 years.

There apparently is some connection between the level of education and employment. The 1956 survey showed that the unemployment rate ranged from 8 percent for those with the least education (average: 9-1/2 years) to 1 percent for college grads.

ENTER THE TEEN-AGE ROCKETEER

With the gyrations of Sputniks I and II has come a new hobby for teen-agers. Across the country, youthful rocketeers and rocket-firing clubs have sprung up almost with missile speed.

A group such as the Austin, Minn., Rocket Society, ten youths ranging in age from 14 to 17 years old, is a good example. The Austin rocketeers recently launched a mouse-bearing rocket to more than 1,000 feet. The mouse was killed, but the rocket achieved speeds of more than 221 mph.

Teen-age rocket interest is both encouraging and worrisome to parents, police, scientists and government officials. Rockets, at best, are tricky gadgets. Other than the obvious danger of explosions, high powered fuels may give off toxic gases and set fires, and rockets may take unexpected, erratic courses.

A high school science teacher was killed and six of his students injured last year in Texas when their test rocket exploded without warning.

Careful, qualified adult supervision is needed. The American Rocket Society is planning to contact 17,000 science clubs and high schools with offers to help teen-agers organize rocket and missile clubs. In some areas, military missilemen have offered launching sites and supervision to youthful rocketeers.

WE'RE LIVING 20 YEARS LONGER

About 20 years have been added to the average lifetime of the American people since the turn of the century. The expectation of life at birth on a nationwide basis has increased to 69-1/2 years.

Figures from the National Office of Vital Statistics indicate that the chances for a white man of age 20 surviving to age 65 increased from 514 to 686 per 1,000 between 1900 and 1955.

At the same time, more than three-fourths of the men aged 50 may now expect to reach the normal retirement age of 65. The expected lifetime of those reaching 65 also has been extended somewhat, the chances of living to age 75 having increased from 545 to 605 per 1,000. Furthermore, the expected lifetime of men aged 75 is now fully 8 years.

"The prospects of survival for females have improved so much that women now have better than four chances in five of living to see all their children reach maturity," Metropolitan Life Insurance Co. statisticians point out.

POWERFUL PARALYZER MAKES SURGERY SAFER

by John W. Robinson

Condensed from Science News Letter

A DRUG that can kill in 60 seconds is now being routinely injected into the human body to make surgical operations safer than they have been in the past.

The drug, and others like it, is known as a muscle relaxant. In nonmedical terms, a muscle relaxant is a paralyzer. A surprisingly few drops of it in the blood stream will cause a normal man to collapse in a motionless heap. He will still be able to think and feel, for this drug, though part of modern anesthesia, is not itself anesthetic, but he will be powerless to even lift an eyelid.

A few more drops and his diaphragm, one of the last muscles to go, would slow down and stop and then breathing would be gone.

Probably the best known of these paralyzers is curare, used for hundreds of years by South American head-hunters to tip their poisoned arrows. A synthetic drug is now being used, however, that is even more instantly lethal than curare and curare-like drugs. Its name is succinylcholine (SUCK-sin-ill KO-leen).

"For modern surgery," Dr. Joel B. Hoberman, chief of anesthesiology at Suburban Hospital, Bethesda, Md., explained, "succinylcholine does in seconds what it used to take ether anesthetic 10 to 15 minutes to do. It completely relaxes the muscles of the body so that the surgeon can do his job without having to fight them. This complete relaxation is a prime requirement of good surgery."

Before the relaxants came along, and when ether was the main surgical anesthetic, this needed relaxation could be brought about in only one way. That was by putting the patient so far "under" that not only was he asleep, but he was gassed to the point that even his breathing was beginning to fail.

If muscles were too tight when the surgeon was ready, he would tell the anesthetist to "pour more on" until he got the degree of relaxation he wanted.

The dangers of ether in the early days were those of time. It may take

ten minutes before the "surgical" stage of ether anesthesia is reached, so there was always the chance that the surgeon would go ahead too fast. The body would still be able to fight back, and a sudden shock—even as seemingly innocent as painting the skin with alcohol — could bring on sudden heart failure.

With the development of quick-acting anesthetic drugs like Pentothal, anesthesiology took a giant stride forward, but still the amount of relaxation depended on how heavily the patient was drugged.

This has all been changed with the development of muscle relaxants like succinylcholine.

Now, the amount of relaxation has little to do with the depth of anesthesia. Only enough anesthesia is given to put the patient in a light sleep, and once this is done, the relaxation is accomplished by succinylcholine.

The relaxant is injected, drop by drop, until the surgeon has been given all the patient's muscle relaxation he needs.

Before being wheeled into the operating room, today's surgery case may get first a tranquilizing pill and then just enough of a narcotic to dissolve his fear. Once on the operating table, a needle is inserted into his arm which can carry both the anesthetic and a slow drip from a marked bottle hanging over his head.

A red warning sticker on the bottle indicates that succinylcholine has been added to the dextrose solution it contains.

By controlling the number of drops per minute that enter the patient's blood stream, the anesthesiologist gives the surgeon the exact amount of relaxation needed: not too little, not too much.

"For lung surgery, the drip rate has to be only one drop more per second than is needed for simple appendectomy," Dr. Hoberman said.

The great value of succinylcholine is that it works extremely fast and disappears from the blood with the same speed. After a single injection of it, complete relaxation occurs in about one minute, lasts for another two, and then is followed by rapid recovery within the next few minutes. A continuous drip is used to prolong the action for as long as needed.

What the drug does in the body is not fully understood, just as the action of ether is not yet completely known. It is known, though, that the drug acts on the spots in the body where the nerves attach to the muscles.

These areas are known as myoneural junctions. Here electrical impulses traveling down the nerve pass across and stimulate the muscle. Technically, succinylcholine is known as a depolarizing agent because it causes a change in the electrical polarity of the muscle fibers. As a result of this change, the muscles receive no nervous stimulation and paralysis results.

Luckily, the drug does not paralyze all muscles, for if it affected heart muscle in the same way it would cause instant death. Its effects are limited to most of the striated

muscles, those attached to the bones.

Succinylcholine has an important advantage over curare and curare-like drugs in that it will easily relax throat muscles.

The larynx remains tense even after a person has been put to sleep with Pentothal. In fact, Pentothal seems almost to sensitize the laryngeal muscles so that any irritation may set off a spasm of the vocal cords. This tendency can be counteracted by giving other drugs before Pentothal, but once in a while a laryngospasm will occur. Succinylcholine can quickly relieve such spasms. It is also useful in relaxing the throat so that a breathing tube may be inserted.

Succinylcholine is remarkably free of any bad side effects, perhaps because its extraordinary power has limited its use to only highly trained anesthesiologists.

In their hands, this powerful paralyzer means a much safer operation for you, and a faster, easier recovery from the anesthetic.

Vernal Equinox Was Once New Year's Day

THIS MONTH'S most welcome astronomical event, the vernal equinox that marks the official beginning of spring in the Northern Hemisphere, occurs on Thursday, March 20, at 10:06 P.M. EST.

Some 200 years ago, however, a new year would also have started with the vernal equinox. In England and its colonies, until 1752, the year began at the spring equinox, arbitrarily set at March 25.

In many earlier calendars, such as that used by the Greeks, the year also started with the beginning of spring. Since this time of year marks the reawakening of nature and the renewal of agricultural and other activities suspended for the winter, it is an appropriate beginning for a new time cycle. The vernal equinox was easy to determine as well.

At the vernal equinox, as at the autumnal equinox in September, the sun rises directly east and sets directly west. Thus the priests, who were also the astronomers of these early times, could tell exactly when the new year had started. Many of the ancient temples, as well as early Christian churches, were oriented to face the sun when it rose directly in the east.

The name equinox is derived from the Latin word for "equal nights," for at this time, theoretically, the day and night will be of equal length all over the globe.

The earth's atmosphere, however, bends the sun's light around the curvature of the earth so that we really see the sun a little before it comes above the horizon in the morning, and continue to see it for a short time after it has set. Thus the day is lengthened several minutes at the expense of the night.

Morning and evening twilight also shorten the night so that at this time in most of the United States, it is dark only about 9 hours instead of 12.

—*Science Service*

Lying just beyond the visible spectrum, affecting your life in a dozen ways, is

INFRARED

Jack of All Trades

by Melvin Mandell

Condensed from Popular Electronics

NEXT TIME you relax under a "heat lamp," stop a moment and consider just what it is that's soothing your muscles. "Heat," you'll say.

True. But the heat you feel is actually infrared energy, an electromagnetic radiation whose frequency ranges from about 1 million to 500 million megacycles — between the microwave region used for high-definition radar and visible light waves.

"Swell," you'll say, and promptly forget about it as you relax under the lamp. Little do you realize that infrared (IR to the trade) can increase the range of radar, help with the problem of aircraft proximity detection, and be useful in a dozen other vital ways.

Consider for a moment:

• IR detectors are used on the new Sidewinder missile, a weapon so accurate that it almost can climb up the tailpipe of a speeding jet.

• Tests are under way with IR detectors which might do more to wipe out air-to-air accidents than radar or any other method known to be under consideration.

• IR instruments for some time have been detecting railroad "hotboxes," saving thousands of dollars and many lives through prevention of accidents.

• IR is being used by modern police laboratories in crime detection.

• IR instruments and controls are already saving industry untold amounts of money.

These and many other examples of the versatility of infrared radiation are actually only the beginning in the exploitation of this little-known area of the spectrum. But if all goes well, millions of dollars will

be poured into research and development of infrared in the coming years.

Although anyone can feel infrared radiation as heat when he turns towards the sun on a clear day, the place of infrared in the spectrum was not discovered until 1800. The famous British scientist, Sir William Herschel, was experimenting with a prism. When he held a thermometer out beyond the red portion of the spectrum he had cast on the wall, the mercury rose. Obviously, there was some invisible radiation from the sun reaching us as heat. It was named "infra-red," from the Latin prefix "infra," meaning "below."

Although scientists continued to investigate the infrared region no practical applications were developed until the early part of this century, when it was discovered that IR was a powerful tool in identifying unknown materials. If you pass infrared radiation through a substance, it will absorb certain parts of the IR spectrum. Each of the millions of different kinds of molecules absorbs a different characteristic infrared frequency.

Despite the fact that identifying unknowns is one of the most widespread activities in industrial research, a practical infrared instrument was not developed for this purpose until the middle 1930's. The honor goes to the American Cyanamid Co., whose instruments proved themselves by helping to keep up production at the government's vital synthetic rubber factories during World War II.

Now thousands of these IR tools, which have the additional virtue of not destroying the sample as several other methods of analysis do, are used in chemical, petroleum, biological, medical, pharmaceutical and crime laboratories.

At the New York Police Laboratory, a physical chemist, Dr. James Manning, has shown that raw opium can be identified as to country of origin by infrared spectrum analysis. His work is contributing to United Nations' efforts to halt the international drug traffic.

New and better drugs are another benefit. A spectrophotometer — an instrument used to analyze light — guided the synthesis of cortisone, the miracle drug for arthritis, and is used to check the quality of many drugs during production. The infrared spectrophotometer has also been used by Gerard P. Kuiper, a University of Chicago astronomer, to determine the composition of the rings of Saturn. He has detected gases on two of Jupiter's nine known moons and confirmed the presence of carbon dioxide on Mars.

During World War II, attempts to develop a first cousin of the spectrophotometer, the infrared analyzer, were made both in this country and in Germany. The Germans produced the first practical instrument, and their design has been reproduced here by a few companies. The analyzer compares an unknown with a known sample by passing infrared radiation through both. Impurities can be detected down to the parts-per-million level with the instrument.

By adjusting the analyzer to de-

tect carbon dioxide, a surgeon can be warned of small but significant changes in his patient's breathing while under the knife. At Presbyterian Hospital in New York, an analyzer has been hitched up to control the volume of air given to patients undergoing surgery. This partial automation of the operating room doesn't eliminate any nurses, but means that the patient's needs can be attended to more rapidly and accurately.

Analyzers are used in respiratory centers — where polio victims are maintained in iron lungs—to check the breathing of each patient a few times a day. One of the instruments also monitors the air on board the atomic submarine *Nautilus*.

City dwellers may some day thank the infrared analyzer for helping to end smog. In Los Angeles recently, 1,000 cars were studied in motion with an analyzer constantly recording what came out of the exhaust pipe. The findings could contribute to development of a new muffler that burns or catches objectionable unburned fume-making hydrocarbons.

Agricultural researchers are also finding the analyzer to be a valuable tool. By reading the carbon dioxide given off by a plant, the instrument tells just how fast it is growing. When northern Maine was struck by a plague of beetles that ate the leaves off thousands of trees, the analyzer was used to tell if the trees were still alive. The dead ones were cut down before worms ruined them for lumber, while the live ones were treated to reach full growth.

The most exciting of the IR instruments — for both industry and medical research — is the infrared camera. Originally developed for military purposes about five years ago, the first IR camera, called the "Evaporograph," was declassified about two years ago, but is just coming into use. Since it converts heat patterns into visible light, it has all sorts of applications where it is important to find one spot that is hotter or colder than its surroundings—and shouldn't be.

For example, it can find spots in the walls of powerplant or steel-mill furnaces that are hotter than the rest. This usually means that the refractory brick at that point is crumbling away. Finding the spot quickly can save a lot of expense and trouble later.

Just a short time ago, the military released another type of infrared camera for peace-time use — the scanning-type instrument. This machine builds up the image in a series of horizontal scan lines like a TV set. While a TV receiver scans the complete screen 30 times a second, this camera scans in fractions of a second, and if the scanning speed continues to rise, engineers may eventually produce an infrared TV.

A Canadian surgeon has experimented with a scanning camera as an aid in finding cancers lying close to the surface of the skin. These cancers may reveal themselves to the camera because they contain more blood and are therefore slightly warmer than surrounding tissue.

You may call for an IR camera

the next time you buy a house. By "photographing" each outside wall, you can tell where there are holes in the insulation or other costly heat-leaks.

Once an unwelcome condition is spotted with the IR camera, an infrared measuring device can monitor the spot's temperature against time.

Riding the nation's railroads, you may chance to see small containers shaped like a wedge of white cheese on each side of the tracks. These are "hotbox" detectors. They can instantly spot a dangerously hot journal bearing box in a car's undercarriage before a wheel is sheared off and lives lost. The switchman in a nearby tower can glance at a chart on his recorder and immediately tell which bearing on which car of a passing train is hot. Ten of these $20,000 systems are now working successfully.

Infrared detectors can also be used to measure dimensions. In dozens of steel mills, pairs of detectors are measuring the width of 100-inch-wide hot steel strip to hold it to an accuracy of 1/8th of an inch as it squirts out of the rolling mill.

There are many other interesting applications of infrared equipment, and new ones are being developed every day. Infrared is already changing your life in many unseen ways and will change it even more in the near future.

Speeding Ambulances Not Needed

THE SPEEDING AMBULANCE is unnecessary and does the accident victim more harm than good. Drs. George J. Curry and Sydney N. Little of the Hurley Hospital in Flint, Mich., have concluded.

From a study of 2,500 consecutive ambulance runs, they found that in 98.2 percent of the cases there would have been no difference in the patient's condition if he had been transported according to standard city traffic regulations.

The other 1.8 percent did benefit from quick and careful handling at the scene of the accident, but speeding back to the hospital could have increased the severity of accident victims' injuries.

Panic in the minds of the public is behind the widespread belief that speed is so important, the surgeons reported.

"The average patient would get there soon enough by parcel post," they quoted Dr. Basil C. MacLean, New York City Commissioner of Hospitals.

The surgeons recommended that ambulances, when transporting injured persons, should observe the local speed laws of the vicinity in which they are traveling. However, they should have the right of way and retain the use of their sirens to avoid any unnecessary delays. Drs. Curry and Little pointed out.

The patient deserves a safe, expeditious ride to the hospital, they concluded in their study, published in the *Journal of the Michigan State Medical Society*.

THE CHALLENGE OF SOVIET SCIENCE

by John Turkevich

Condensed from The Atlantic Monthly

MODERN SCIENCE is the result of contributions from many lands.

The nuclear age was ushered into the 20th century by the work of Germans: Planck, Heisenberg, and Hahn; of Frenchmen: Becquerel, Curie, Joliot; of Englishmen: Rutherford, Aston, Cockroft; of a Swiss: Einstein; of a Dane: Bohr; and of Americans: Compton, Lawrence, Urey, and Rabi.

The periodic table of chemical elements, though it was drawn up in the 19th century by the Russian, Mendeleev, was, in the same way, a necessary link in the chain of discoveries and theories that gave birth to nuclear physics.

The basic facts of science and the theories invented to explain them are universal and are largely impervious to national transformations.

International cooperation in science has guaranteed not only a minimum of unnecessary duplication but has assured an invaluable cross-fertilization of ideas and helpful criticism.

During much of the last four decades, and particularly under the tyranny of Stalin, the Soviet Union set out to violate almost all principles of universal science. Locked up in the shell of its national existence, Russian science was weakened by its isolation from the constructive cooperation and helpful criticism of the West.

During this period of repression, scientific work was nevertheless carried on in almost all important fields except genetics. The Soviet scientist, particularly if he was working in an area closely associated with projects involving national defense or the country's well-being, suffered relatively little from the ideological turmoil of the time.

His profession was respected. His economic situation was far superior to that of his fellow citizens, and as a result Russian youth continued to be drawn to the fields of science and technology. The scientists who really suffered were those who enjoyed close associations with the West, and it is they who have benefited most from the significant change in climate since Stalin's death.

Today a superficial calm has settled over the previously harassed scene of Soviet science. The isolation of Russian scholars from foreign colleagues has been partially lifted. . . . Some of the banished scholars have reappeared, and their reputa-

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tions seem to have been rehabilitated. Science is now discussed and promoted not as an expression of Communist ideology but as an independent activity of the mind, endowed with its own principles, traditions, techniques, and universality.

WE TOO OFTEN FORGET that Soviet science inherited a proud tradition from Czarist Russia; 250 years ago, Peter the Great was already fully conscious of the growing importance of science and technology. It was this great Westernizer who drew up the plans for the Imperial Academy of Sciences, which was established in 1725 by his wife and successor, Catherine I. To staff it in its formative years foreign scientists were imported, among them were some of world-wide reputation, such as the mathematician Leonard Euler, who gradually developed a nucleus of Russian scientists in St. Petersburg. A striking product of this development was Michael Lomonosov, a many-sided 18th-century genius who founded the University of Moscow and contributed to many branches of learning.

In the 19th century, Russian science was far enough advanced to produce several outstanding scientists: Lobachevski, with his formulation of a new non-Euclidean geometry; Mendeleev, with his periodic table of elements; Pavlov, with his theory of conditioned reflexes.

In addition there was a host of competent, though less well-known, scholars. Thus in 1917, when the Soviets seized power, they inherited a well-established, though somewhat staid, Imperial Academy of Sciences; four world-renowned universities at Moscow, St. Petersburg, Kiev, and Kazan; and a small group of highly competent experts in every branch of science and technology.

This heritage from Czarist Russia served as the platform for the astounding scientific and technological development that has since occurred in the Soviet Union.

SOVIET SCIENCE TODAY, like most of the activities in the Soviet state, is highly organized and under direct government control. Research is carried out under the auspices of the U.S.S.R. Academy of Sciences at the Academy institutes, under the Ministry of Higher Education at the universities, and under various specific government ministries at plant laboratories.

At the apex of pure research activity stands the U.S.S.R. Academy of Sciences, the revitalized and enlarged successor to the Imperial Academy. The Academy of Sciences is a self-perpetuating body of learned men who, by Soviet law, are responsible for the progress of scientific and scholarly work in present-day Russia.

The Academy is divided not only

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into scientific departments—physics and mathematics, chemistry, geology, biology, and engineering—but also into departments of history and philosophy, economics and law, literature and linguistics.

Election to the Academy is by secret ballot and in most cases is a direct reward for recognized scholarly accomplishments.

Great prestige is attached to membership, and this prestige finds its material expression in a lifetime monthly grant of 2,500 rubles for corresponding members and 5,000 rubles for academicians. (For our purposes seven rubles can be considered equivalent to one dollar.)

This grant is awarded in addition to whatever income the member may receive from his research or teaching posts. Membership in the Academy also carries with it special privileges, such as superior housing, both in Moscow and in the country. The value of these rewards is enhanced by the fact that the average income tax in the Soviet Union amounts to less than 5 percent.

The governing body of the Academy is a presidium composed of the president (at present Alexander Nikolaevich Nesmeyanov), the secretary general (Alexander Topchiev), seven secretaries from the respective departments, four presidents of academies of the associated republics, and eleven other academicians. The presidium advises government agencies, formulates a general scientific program, passes on research proposals, allocates funds and personnel for the various institutes under it, and evaluates the results obtained.

In directing and coordinating the intellectual efforts of the Academy, the presidium is guided by two principles.

The first is the search for key research problems, whose solution promises to open up broad avenues for future scientific development.

The second is the studied application of scientific discoveries to the growth and modernization of the Soviet Union.

This latter aim is fulfilled in a number of ways. Crash programs are established on major objectives such as atomic energy, aeronautical science, calculating machines. General targets and psychological rallying-points are set for each year, and these may take such forms as "The science of building dams and hydroelectric stations," "Science as an aid to agriculture," "Science to aid reforestation," and so on.

IN RECENT YEARS these broad objectives have been replaced by more specific targets such as the development of rapid digital calculators, the solution of problems in theoretical physics, industrial automation, electronic and semi-conducting devices, catalysis, protein chemistry, high-temperature alloys, and power production.

The successful launching of several earth satellites is a dramatic tribute to the presidium's ability to coordinate the requirements of national security (in the field of rocketry) with a highly imaginative

program of pure scientific research.

Graduate work in the Soviet Union leads to two degrees—that of *kandidat* and doctor of science. It can be carried on either at universities or at the 126 institutes of the Academy. The *kandidat* degree would appear to be of a slightly lower standard than the American Ph.D. degree, but is definitely more advanced than our M.Sc.

Fundamental research is carried out in Academy institutes. Their laboratories are well equipped with fine scientific equipment, much of it of Soviet manufacture. The Academy employs a total of 35,000 persons. Of its 13,676 scientists, 145 are academicians, 319 are corresponding members, 1,216 have a doctor of science degree, and 5,187 that of *kandidat*. In 1956 there were 2,863 Communist Party members on the rolls of the Academy. Of the 24 members of the presidium, 15 are Party members.

Research is also carried out at the laboratories of the universities and engineering schools under the Ministry of Higher Education. However, the scientific accomplishments of the universities—with the exception of those of Moscow, Leningrad, Kiev, and Kazan—are of minor importance compared to the work of the Academy institutes. This is in marked contrast to the situation in the United States and in Western Europe, where most of the basic research is carried out at the university laboratories.

• Our choice is brutally clear. As a society, we can either learn mathematics and science—or Russian.
—Dr. Lawrence R. Hafstad

Applied research is carried out in the many laboratories associated with various government ministries. Research connected with problems specific to the different Union republics, such as Ukraine, Armenia, and so on, is performed in the laboratories and institutes of the academies of the Union republics. A coordinating committee of the U.S.S.R. Academy and an interlocking directorate permits close cooperation between the supreme U.S.S.R. Academy and the regional ones. In recent years Moscow has sought also to bind the scientific activities of the satellite countries firmly to the Soviet orbit by setting up a nuclear science center near Moscow for the benefit of satellite countries.

IN RUSSIA, as elsewhere, mathematics still dominates the scientific scene. The field of mathematics is one in which Russia has traditionally been strong. One of Einstein's first mathematics instructors — at the Zurich Polytechnic — was Hermann Minkowski, by birth a Russian. Algebra, geometry, and the theory of probability have received a steady contribution of new approaches and formulations from a galaxy of brilliant mathematicians, led by Vladimir Vinogradov, a foreign member of the Royal Society in London.

In the field of mathematical physics the Soviet Union can likewise boast of the achievements of Lev D.

Landau, the brilliant theoretician of the atomic nucleus, and of many other first-class scientists like Nikolai Bogolyubov, Vladimir Fok, and Igor Tamm.

In recent years the Soviet Academy has paid great attention to the development of electronic calculating machines. Three years ago its presidium announced the establishment of a Computer Center and the operation of two giant computers. Today the Soviet Academy claims that its two giant computers, the BESM and M-2, are the most rapid in Europe, and that the BESM has been successfully used to translate English into Russian.

The same signs of progress are evident in the field of Soviet astronomy. Two of Russia's most important observatories which were completely destroyed during World War II — one at Pulkovo near Leningrad, the other in the Crimea—have been rebuilt within the last three years, and a Soviet astronomer named Maskutov is presently working on the construction of the largest telescope in the world.

The same pattern can be found in physics, which has three very active branches: the study of the nucleus, of solids, and of low temperatures. Soviet scientists have been active in all three fields. Their achievements in the military application of nuclear physics are the subject of government pronouncements and of international preoccupation.

But Soviet progress has been no less notable in the peaceful uses of atomic energy. The Russians put their first atomic power station (for 5,000 kilowatts) into operation near Moscow in the summer of 1954, and at the Geneva Conference on the Peaceful Uses of Atomic Energy in 1955 they revealed and freely discussed the details of its construction.

At present Great Britain has an atomic energy power station at Calder Hall (with a capacity of 28,000 kilowatts), the French have one of 5,000 kilowatt capacity, and we have none. During 1958, the United States expects to generate 112,500 kilowatts of atomic power when Shippingport and other atomic plants are in full operation.

But in the meantime a whole series of atomic power plants is being constructed in the Soviet Union which, according to the latest Russian claims, will provide an estimated 2.5 million kilowatts by 1960. At that time the United States plans to have about 1 million kilowatts of atomic power available.

ANOTHER interesting race is going on between the United States and the Soviet Union in the construction of larger and larger nuclear accelerators. Before World War II the Soviet Academy had built the largest cyclotron in Europe. At about the same time McMillan in California and Weksler in Moscow proposed a design for an accelerator which would avoid the complications introduced by the variability of the mass of the accelerated projectile (as previously indicated by Einstein).

Shortly after World War II several accelerators of this design, called

synchrotrons and attaining 400 million volts, were built in the United States. It was not until 1955 that the Soviet Academy of Sciences could issue scientific reports describing results obtained from the development of a 600 million-volt proton synchrotron in Moscow.

Though this accelerator is to this day larger than any of the same type in the United States, we had already constructed and put into operation accelerators of other types — a 3.6 billion-volt accelerator at Brookhaven; but the Russians have already countered by revealing their intention of constructing a 50 billion-volt machine. Some appreciation of the magnitude of this international race in particles acceleration can be drawn from the fact that the magnet of the Russian 10 billion-volt machine weighs 36,000 tons!

In the field of physical chemistry, a notable recognition of recent Soviet achievements was the award of the 1956 Nobel Prize to Nikolai Semenov. It was Semenov who in the 1920's formulated the first complete and consistent theory of explosions and combustion. This theory was later extended and applied to the design of nuclear reactors and weapons.

Some mention should be made of one other field where the Russians are accomplishing prodigious feats— that of scientific publication. It is through scientific journals that scientists keep abreast of recent developments in their own country and abroad. Information thus obtained may be used to modify research programs to avoid wasteful duplication, or may stimulate fertile new research.

The Soviet Academy of Sciences has an enormous publishing program: in 1954 it produced 296,000 printed pages and in 1955, 416,000. The Academy publishes over 50 weekly, monthly, and bimonthly journals, which report original scientific work carried on all over the Soviet Union.

To keep abreast of scientific discoveries in the West, three media are used: review journals, translations of foreign treatises, and an abstract journal. The four review journals which cover the fields of mathematics, physics, chemistry, and biology contain well-written articles providing detailed surveys of subjects of current scientific interest.

In addition to this, the Information Bureau of the Academy has begun the publication of information bulletins in a further attempt to keep Soviet scientists informed of developments in critical fields. For the past three decades it has been the policy of the Academy to translate and publish all important American, English, French and German scientific treatises.

Abstract journals are likewise indispensable for efficient scientific work, for these periodicals condense scientific articles into short pithy items, arrange them into sections under subject headings, and index them by subject, author, and formula.

Publishing an abstract journal is a very expensive enterprise which is carried out in the fields of chemistry and biology by the United States and

in the field of physics by England. In 1953 the Soviet Academy of Sciences embarked on the publication of an abstract journal, *Referate*, which will cover *all* fields of science. In one year, 1955, the number of pages in the abstract amounted to some 36,600.

BEFORE World War II only a few countries, the United States, Britain, and Germany, could muster sufficient strength to be active on all the frontiers of science. But 12 years after the end of the war, the Soviet Union has joined the ranks of the major scientific powers.

Today we see a nation, endowed by nature with a vast expanse and vast resources, determinedly building its future on science and technology. For this purpose it inherited from Czarist Russia a solid tradition. Under the Soviet regime it has built up a powerful organization and extensive laboratories. The state has provided generous funds for science and education, and it has given both its scientists and educators thorough professional training, financial well-being, and social prestige.

Creative invention, however, requires a proper social, political, and cultural climate, in which freedom to think and to question, to share one's doubts and hopes with others, and to make mistakes are all necessary privileges.

Continuity of creative endeavor is also favored by an inspiring teacher who transmits his personal enthusiasm for creative work to future scholars. How else can one explain the appearance of magnificent, creative minds in countries lacking a highly developed scientific organization — such as Italy, which produced Fermi, Segre, Amaldi, and Rosetti; or Hungary, with its von Neumann, Teller, Wigner, Szilard, and Polanyi? How else can one explain the absence of creative work in the Soviet Union under Stalin?

THE CREATIVE SCIENTIST who arises from society in an unpredictable fashion and leaps beyond the recognized barriers of his time is of a naturally rebellious temperament which often makes him *persona non grata* in a totalitarian regime. A political system must allow at least a minimum of intellectual freedom and elbow-room to tolerate and nurture him.

Under the ideological tyranny of Stalin this type of individual was stifled. Under Khrushchev's milder rule he may arise to lead Soviet science to new heights. The emergence of such creative leadership is likely to affect all the other higher strata of intellectual life in the Soviet Union: its politics, economics, and its artistic and ideological culture.

But it would be a grave mistake to jump to the hopeful conclusion that the emancipation of Russian science will of itself suffice to relax the pressures of Soviet imperialism.

The achievements of Soviet science are here to stay, and, for good or ill, they present a challenge which must lead us to re-examine the place we have accorded science and scientists in our free-enterprise society.

IS IT "CURTAINS" for the CROCODILE?

by H. B. Cott

Condensed from The Listener (England)

ON THE SOUTH BANK of the Victoria Nile, a few miles above its entry into Lake Albert, there is an open space of bare mud. Here the earth has been worn as flat as a parade-ground by crocodiles that for centuries have used the place to bask in the sun and to guard their nests.

At early dawn the beach is deserted, but with the coming of day the first crocodile cruises towards land. Swimming with majestic sweeps of the muscular tail, his arms and legs folded back against the body, he comes in like a great fish.

After lying for a time in the shallows, with head and shoulders exposed, he laboriously heaves his half ton of weight out of the water and comes ashore. Having chosen a resting place he turns about to face the water, sweeps his tail in a half-circle, and settles his feet firmly on the mud. Soon he is followed by others, until the beach is so crowded that newcomers have to climb over the bodies of their companions to find a place.

Scenes such as this were once common, but today such spectacular congregations have entirely vanished, except from the few game parks and reserves where the reptiles enjoy government protection. Many factors have contributed to the crocodile's decline. New facilities for travel, land development, drainage of swamps, hydroelectric schemes, the spread of modern firearms, and the hunting of crocodiles in the supposed interests of humanity — all have had their effect.

But during the last decade a new

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factor has drastically reduced the dwindling stock. The crocodile produces the best-known type of leather, and the high prices paid for the hides has made the export of skins almost a major industry.

The Nile crocodile is now fast losing ground almost everywhere in Africa, and this decline is accelerating. To cite an example: The Lower Semliki River and the adjacent shores of Lake Albert were formerly one of its strongholds. Towards the close of the last century one observer described how the reptiles lay on their favorite basking grounds "as closely packed as sardines."

Thirty years later other observers reported from the Semliki delta an unprecedented number of crocodiles, far exceeding the famous congregations seen along the banks of the Nile in the Murchison Falls National Park. When the change did come about, however, it was comparatively sudden.

One hunter told me that in 1948 he had shot 30 crocodiles in a morning. In the early 1950's a commercial concern began its hunting operations in the area. By 1952 the population was so reduced that hunting had become unprofitable. As an official of the company put it: "Our chief difficulty is to find new hunting grounds."

Similarly in Lake Victoria crocodiles have been drastically reduced. All around the shores of this great lake crocodiles of mature size are fast disappearing; and along stretches of coast where a few years ago 30 or more could be seen, today in the same area you may discover one or two or none at all.

Under natural conditions the monitor lizard and the crocodile kept each other in check; the lizard preying upon the eggs and newly hatched young, and the adult crocodile preying upon the monitor.

But present depredations by hunters in the breeding grounds has favored the lizard, which is quick to exploit the guardian crocodile's temporary absence from her nest. The lizard is now said to be on the increase and, together with the hunter, is taking its toll of the potential breeding stock.

Meanwhile the professional hunters, who shoot at night with the aid of a spotlight, are relying for their profits more and more upon young crocodiles whose skins find a ready market in London, Paris and New York.

These juveniles, measuring between 3 and 6 feet in length, are sacrificed long before they reach sexual maturity, and with complete disregard for the future of the crocodile, or of the industry.

It is not only the traders who are concerned. With the crocodile's decline other effects are beginning to be noticed. For example, in parts of Southern Rhodesia where the reptiles, formerly abundant, have now been hunted nearly out of existence, fresh-water crabs have increased and

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are reported to be feeding on the recently hatched offspring of the food-fish *Tilapia*.

In southern Lake Victoria African fishermen now complain that lungfish—favorite food of the crocodile—are on the increase and are mutilating fish in their nets.

A recent report of the East Africa Fisheries Research Organization states that the otter is also causing an increasing amount of damage to netted fish. In Madagascar, as in Africa, the high prices paid for skins have led to wholesale exploitation, and in some areas crocodiles have been virtually exterminated, with far-reaching results no one expected.

• Life is not a miracle. It is a natural phenomenon, and can be expected to appear whenever there is a planet whose conditions duplicate those of earth.
—Harold C. Urey

The director of the Institute of Scientific Research, at Tananarive, Madagascar, reported last year that the destruction of crocodiles had coincided with an increase in the island's population of stray dogs, and consequently of rabies; wild pigs were also multiplying, with consequent damage to cultivated crops.

Such changes in the pattern of nature may serve as a warning. But hitherto we have had little precise information on the crocodile's relation to fisheries and to general biological economy.

Nor do we yet know what will happen if the drastic reduction likely to result from present intensive hunting is allowed to reach a point from which recovery is impossible.

In any case, there is a need for research in the field. Because of this I was invited by the Government of Northern Rhodesia to undertake an investigation in the swamps of Bangweulu and other waters of the Northern Territory last year.

The main problem was an attempt to assess the relation of the crocodile to other members of the animal kingdom. And, as it seemed to me, the key to this problem was likely to be found in the crocodile's stomach.

Analysis of food recovered from Rhodesian crocodiles and others I had examined showed that there was no simple answer to the question: what does the crocodile have for dinner? However, two things soon became clear: that the feeding habits change progressively throughout the animal's life; and that the kinds of prey and the proportions in which they are taken differ widely in different areas.

Certain other broad conclusions stood out. In the first place, the survey exposed a number of popular fallacies—such as the generally held opinion that crocodiles are voracious feeders; that their main food is fish; and that they consume enormous quantities of commercial varieties.

Field observations, and the examination of specimens from different waters, led to the conclusion that the crocodile enjoys a leisurely life, that it requires little food, and that it troubles to take only the little that it needs. Empty stomachs are frequently encountered in crocodiles of

all ages; a meal of any size is rare; and a full meal exceptional.

It has long been suspected that the diet and habits of crocodiles may change with the predator's age. But few observers in the past have recorded both the stomach contents and the length of animals examined. Recent work has shown that striking changes do occur in the diet of various age-groups.

Young crocodiles have good reason to avoid the company of their elders — for the Nile crocodile is much addicted to cannibalism. Thus it is that the juveniles shun the open waters and basking-grounds, living instead in seclusion among the stems of papyrus or shore debris in weedy shallows.

Here, for the only time in their lives, they show climbing ability, scrambling about the swamp vegetation in search of insects and spiders upon which they subsist almost entirely during their early life.

Later, other items are added — toads, frogs and tree-frogs, crabs and molluscs. Fish, rodents, and small birds are only occasional items on the menu at this stage.

Gradually the pattern changes. Adolescents take more to the water, feeding at night; and by the time they reach an age of eight or ten years, their diet is mainly fish.

With further growth, fish tend to be neglected in favor of reptiles and mammals. The veterans capture a wide variety of prey—ranging from hippopotamus calves, buffalo, waterbuck and other game to waterfowl, pythons, cobras, soft-shelled turtles, monitors, and smaller individuals of their own kind.

Examination of crocodiles from the extensive Bangweulu swamps yielded unexpected results. For here the main prey is a large gastropod mollusc. These water snails were recovered from crocodiles of all sizes. One of the largest had more than 800 snails in its stomach.

The habits of crocodiles living in the opaque alkaline water of Mweru Wa Ntipa, near the Belgian-Congo border, were again exceptional. These animals fed almost entirely upon *Clarias mossambicus,* a catfish that itself preys upon *Tilapia* which in turn is an important commercial fish.

In so far as the crocodile keeps *Clarias* in check, there can be little doubt that it is beneficial. Crocodiles are at present plentiful in Mweru Wa Ntipa, where they are strictly protected.

In any attempt to assess the harm done by crocodiles, account must be taken of the complex food chains involved. For example, both in Rhodesia and Uganda the species of fish eaten are primarily scavenging or predatory forms that feed upon fish or eggs. In addition, adult crocodiles include otters and the marsh mongoose and many fish-eating birds in their bill of fare.

Thus it would appear that crocodile hunting will not necessarily benefit fisheries. But more important is the part played by young crocodiles. In all areas where they have been studied, the juveniles are found to feed extensively—during the first five or six years of life—

upon giant waterbugs, nymphs of dragonflies, carnivorous water-beetles, and fresh-water crabs. All these invertebrates feed, as larvae or adults, upon young fish.

And so the conclusion may be reached that crocodiles are not detrimental to fishery interests, except in so far as they damage gear or endanger life. On the other hand, recent research indicates that in certain waters the presence of crocodiles may be beneficial to the industry.

In the popular mind, crocodiles arouse feelings of fear or hatred; and officially they are still often classified as "vermin." If a crocodile eats a catfish or a cobra, no one is any the wiser. But if the unfortunate victim is an ox or a man, the fact is soon widely known. Happily, human casualties are today comparatively rare. But when accidents do occur they have news value.

The crocodile's misdeeds are magnified in the press, and are seized upon by the professional hunter as justification for a pursuit which has as its main objective not humanitarian considerations but personal gain.

In Africa, crocodiles have already been exterminated from the south, and from the second cataract of the Nile northwards, and from most of Kenya. Ruthless exploitation has reduced other crocodiles throughout the tropical world until in many countries where they once flourished they are now almost a curiosity.

Crocodiles essentially like the modern forms were contemporaries of the dinosaurs. These only remaining survivors of the Age of Reptiles are thus of quite exceptional scientific interest. Their anatomy is of extreme importance in tracing the evolution of the higher vertebrates, while their distribution throws much light upon the biology of their ancestors and former land connections.

It would be a grave loss to science if these saurians — which have survived for over 100 million years— were now to be sacrificed to the demands of uninformed public opinion and private profit.

Housefly Winning Insecticide War

THE COMMON HOUSEFLY has won another round in the insecticide battle. G. C. Labrecque, U. S. Department of Agriculture entomologist, reports that the flies are becoming increasingly resistant to the widely used organophosphorus insecticides.

During the past five years these insecticides have replaced DDT and other sprays to which flies had become resistant. In recent experiments, USDA scientists found flies collected from some Florida dairies and poultry houses were as much as 133 times as resistant as normal flies to malathion sprays.

In some strains of houseflies, Labrecque pointed out, resistance to Dipterex or malathion baits has more than doubled since 1956.

Insecticides to which resistance is appearing in houseflies also include Diazinon and parathion.

Besides counting heads, the Census Bureau tabulates everything from farms to movie theaters

America in Numbers

by Charles Simmons

Condensed from The New York Times Magazine

THE BUREAU OF THE CENSUS counts more than heads — and counts continually, not just once a decade. Almost everything about America that can be expressed in numbers becomes a subject for the bureau's scrutiny: death and taxes, roads and airfields, divorces and births, elections and prices, crimes and farms, banking and strikes, parks and imports, drainage and freight, telephones and fish, restaurants and immigrants, rivers and bankrupts, stocks and diseases.

Once a year the bureau recounts the story of its counting, when it publishes — as it did a few months ago—*The Statistical Abstract of the United States 1957,* bringing the great decennial census up to date. These figures range in forbidding complexity, but what forces the mind to enter and re-enter the statistical jungle is the suspicion that here, as nowhere else, is a definition of America. You see a great land made of many pieces, a land of large appetites and equally large energies expended to satisfy them. Also, you see the stuff of folklore.

Is it, for instance, really true that more Americans marry in June than any other month? Indeed, it is. Twice as many, in fact, as during the least popular month, February. In between, the months rate in this order: August, September, December, October, July, May, November, April, March and January.

How old are Americans when they

New York Times Magazine (Nov. 17, '57).

marry? The latest figures show that the bride is 20.3, the groom 23.1, which is a slight decrease over the immediate past. Of the states reporting, both bride and groom marry youngest in Idaho (19.1 and 22.2) and the oldest in Connecticut (22.0 and 24.7). These unsentimental numbers do not leave their subjects to live happily ever after. Thus, the median age for remarrying, we find, is 34.7 for brides and 39.4 for grooms. Both remarry oldest in New York State: 38.1 and 43.4.

New York City, despite its size, is not statistically an extreme place. Local patriots might be hard put to prove much from the facts provided. But nestling in the great mass of data is the consoling intelligence that, of the major cities sampled, New York is the cheapest place to buy a pair of eyeglasses — $14.58, compared to, say, $28.92 in Kansas City.

Generally, the most inexpensive city to get sick and well again is Scranton, Pa., where you can have a private hospital room for $11.50 a day (against a price of $25.19 in San Francisco), a baby for $72.67 ($145.83 in Atlanta) and a tooth filled for $3.33. The best spot to have your tonsils out, however, is Minneapolis, for $46.67; the worst, Los Angeles, for $100. Prices are subject to change without notice, as you may learn if you quote these to your physician.

Poking about among the bureau's figures can be like reading the Kinsey reports, where much is learned about sex and little about love. If they are to be meaningful, one must bring to the data a certain familiarity with America, as one must bring to Kinsey a familiarity with love.

There are statistics that will be replete with emotion for some. One table in particular, entitled "Armed Forces Personnel—Summary of Major Conflicts, by Branch of Service," represents more tears and blood than ever flowed in an epic poem.

Here you have American battle deaths: Civil War—140,414*; Spanish American War—368; World War I—53,398; World War II—291,557; Korean conflict — 33,647. In the words used to mark the categories one sees an official irony: "Korean conflict." Thirty-three thousand six hundred and forty-seven battle deaths in Korea, and the engagement does not achieve the status of a war. History may change that.

Another list of numbers refers to the same wars and "conflict": 281,881; 1,654; 203,376; 670,846; 103,259. These are "wounds not mortal." The words, cold and exact as statisticians can make them, nevertheless sound loud overtones. One perhaps recalls the phrase "million-dollar wound," spoken in World War II by brave men, who had fought and would fight again, to describe the badge of honor that was sending the man from the next foxhole home to family, rest and life.

On the far side of honor the figures tell a sad tale of the trouble some Americans make for their neighbors,

*Deaths in the Union forces. Exact figures on Confederate deaths are not available.

MURDER, non-negligent manslaughter and disorderly conduct are pretty evenly distributed throughout age groups. Assault, embezzlement, fraud and drug offenses hit their peak in the middle years.

AT LAST COUNT, there were 73,352 places of recreation in the U.S. There were 7,639 billiard or pool parlors, 2,488 amusement parks or shooting galleries, 1,090 carnivals and circuses, and 1,246 horse tracks.

IS IT TRUE that more Americans marry in June than in any other month? Indeed it is. Twice as many in fact, as during the least popular month, February. The second most popular month: August.

MOVIES have lost spectators. Between 1948 and 1954 the number of motion-picture houses in the country dropped from 17,689 to 14,716; gross movie income dropped from $1,567 million to $1,179 million.

WORLD WAR I resulted in 53,398 American battle deaths; there were 291,557 in World War II. "Wounds not mortal" received in World War I numbered 203,376. In World War II, 670,846 Americans received non-mortal wounds.

PRICES are subject to change, but New York City is the cheapest place in which to buy a pair of eyeglasses; in Scanton, Pa., a private hospital room costs $11.50 per day; a tonsillectomy costs $46.67 in Minneapolis.

and what their neighbors do about it. One table breaks down arrests by the age of the criminal and the nature of the crime.

During 1956, in the localities reporting, 18,622 persons under 18 were arrested for auto theft, while only 144 aged 50 and over were arrested for the same crime. Contrariwise 6,469 under 18 were arrested for drunkenness, against 219,422 aged 50 and over. Not only auto theft but robbery and burglary seem to be crimes of the young, while vagrancy, along with drunkenness, is a crime of the old.

Murder, non-negligent manslaughter and disorderly conduct are pretty evenly distributed throughout age groups. Assault, embezzlement, fraud and drug offenses hit their peak in the middle years. All groups considered, drunkenness accounts for most arrests, with disorderly

conduct, drunken driving, larceny-theft, vagrancy and burglary following in that order.

As you make your way among the abstractions you realize that the intention of the bureau is to show America's dynamic as well as her status. In 1950 only 3 cents of the nation's advertising dollar were spent in television; 12.6 cents were spent in 1956. At whose expense did TV make these gains? Primarily radio's, which commanded 10.6 cents of the 1950 dollar and only 5.7 cents in 1956. Part of it, too, came from newspapers, which dropped from 36.3 to 33.1 in the same period; part from magazines, which fell from 9.0 to 7.8.

Television raids have not, of course, been limited to advertising revenues. Movies have lost spectators. Between 1948 and 1954 the number of motion-picture houses in the country, dropped from 17,689 to 14,716 and the gross movie income from $1,567 million to $1,179 million.

This decrease is hardly a trend as far as the American pursuit of a good time goes. At last count, there were 73,352 places of recreation in this fun-loving country, of which 7,639 are billiard or pool parlors, 2,488 amusement parks and shooting galleries, 1,090 carnivals and circuses, 1,014 commercial and 2,996 membership golf courses, and 1,246 horse tracks.

The category does not include 29,432 motels, 31,240 liquor stores, 8,132 delicatessens, or 123,887 "drinking places." Thinking on this last figure, and noting that there are 2,642 bookstores in the land, one tends to agree with Housman about malt doing more than Milton can to justify God's ways to man.

All this is the merest peep at the extraordinary amount of information the bureau gathers. Another peep might have shown that cars were driven more slowly in 1956 than in 1955; that the death rate from heart disease is almost twice as high in New England as in the Mountain States; that the easternmost point of the nation is West Quoddy Head, Me.; that there are more doctors per patient in the District of Columbia and more patients per doctor in Mississippi than anywhere else in the land; that Alaska pays its teachers more than any of the 48 states; that the suicide rate was two-thirds last year of what it was in 1930.

Things like that.

EVERY OTHER PERSON who began teaching last year plans to quit teaching in five years. Two out of every ten new teachers last year did not even plan to return to teaching this year. This surprising and unexpectedly high turnover in beginning teachers was uncovered in a questionnaire survey made recently by Dr. Ward S. Mason, a specialist in teacher personnel statistics at the United States Office of Education.

GOOD PROTEIN DIET IS ESSENTIAL TO GOOD HEALTH

When children get too little protein or poor quality protein in their diet, they will be much more susceptible to infections, it is indicated in mice experiments at the Rockefeller Institute for Medical Research. Dr. Rene J. Dubos told the National Academy of Science that he was able to infect mice on a low or poor protein diet with varying amounts of tuberculosis germs as well as other bacteria, but that those with normal protein intake were resistant.

In a report to the American Public Health Association, Dr. N. W. Flodin of E. I. du Pont de Nemours & Co., said that "low efficiency" protein can be converted to "high efficiency" by adding an amino acid, lysine, to flour. Lysine, one of the building-blocks of protein, need only be added in the ratio of a quarter-pound to 100 pounds of flour. This will restore the amount of lysine that is lost from whole wheat in milling to white flour.

Lysine supplementation would not only benefit people in many "protein poor" areas of the world where wheat foods are dietary staples, but would also aid people in the U. S. with a low protein intake, says Dr. Flodin. These include children, pregnant women, adolescents, the aged and underprivileged.

BLIND 18 YEARS, WOMAN "SEES" WITH AID OF ELECTRONICS

The possibility of "electronic vision" is held out by Dr. John C. Button, a South Orange, N. J., neurologist, who was able to cause a blind woman to see light flashes by stimulating certain brain cells with electrical current. The 35-year-old woman had been blind for 18 years because of pressure of a tumor on her optic nerve.

Wires about half the thickness of a human hair were passed through drilled skull holes into the patient's centers of vision in the brain. The wires were attached to a transistor amplifier, which was connected to a small photoelectric cell. The theory was that the photoelectric cell would pick up light and convert it into electrical current that would stimulate the brain cells.

The patient was given the cell and told to point it around a darkened room. As it encountered lights placed around the room, she "saw" flashes of light. She was able to pick up flashes as dim as those of a 40-watt bulb.

Doctor Button said that within the next five years it may be pos-

rogress
EDICINE

by Arthur J. Snider

sible to refine the apparatus to transmit patterns of light. From there it might be developed to convert actual images into electric current, just as in radar or television. He believes the technique might be made to work on any blindness except in cases of injury to the centers of vision deep in the brain.

THREE "P'S" FOR THE ACNE PATIENT

Acne is a serious disease, not so much as it affects the general health but in so far as it affects a youngster's well-being. There is no magic yet perfected that can bring about a quick cure, says Dr. David W. Folan, Jr., of Tufts University, Boston. But he listed three "P's" that will bring good results.

The first of these is patience, the second is perseverance in carrying out the doctor's recommendations, and the third is precipitated sulfur, the medication that Dr. Folan prescribes to combat the oily skin of the adolescent.

Successful treatment of acne requires removal of greasy plugs in the hair follicles and fat ducts of the skin, says Dr. Folan.

DENTIST RATHER THAN DOCTOR OFTEN DETECTS MOUTH CANCER

Since a dentist sees his patients twice a year, he often is in the unique position of detecting cancer of the mouth before a physician, points out Dr. James R. Cameron, professor of oral surgery, Temple University.

Another medical problem often turning up first at the dentist's office is anemia. Tuberculosis also can be detected first, in many cases, in the mouth. Leukemia may be spotted because of changes in the gums and mucous membranes, Dr. Cameron told the American Medical Association convention.

ALCOHOLISM MAY RESULT FROM HEREDITY, STUDY SHOWS

A group of male alcoholics, studied by a team of Texas researchers, was found to have different biochemical characteristics when compared to a normal group of men who drank only in moderation. Dr. Roger J. Williams said the alcoholics differed in total number of white cells, in the amount of sodium, potassium and calcium in the blood, in their blood sugar and in the chemical composition of urine. While the evidence is far from complete, says Dr. Williams, there is a strong presumption that a number of these items are under genetic control. →

COFFEE AND NICOTINE RACE HUMAN MOTOR

Overindulgence in stimulants — coffee, tea and nicotine—may lead to the same symptoms as an overactive thyroid. Dr. Arnold J. Jackson of Madison, Wis., tells of 228 cases sent to him for thyroid treatment when the patients' only difficulty was consumption of large doses of barbiturates, tranquilizers and other drugs in an effort to combat the nervous stimulation of coffee and tobacco.

Doctor Jackson said, in effect, that the patients were "racing their motor" as a result of what he calls "nicotinitis" and "coffeeitis." They suffered weight loss, heart palpitations, moist warm skin, tremor of the fingers, nervousness and insomnia. These same symptoms occur in cases of overactive thyroid.

The only treatment necessary, he says, is to withdraw the stimulants and the counteracting drugs and restore the patient to a normal routine.

WHY DO WOMEN LIVE LONGER THAN MEN?

Each year, 200,000 more men than women die in the United States. By 1975, women are expected to outnumber men by 3,600,000. There are now 7,700,000 widows in our population and the number is rising sharply.

The Health Information Foundation suggests that medical science is challenged to find an answer to this problem before American males become in effect "an underprivileged segment of the population."

It is possible, the foundation says, that there are biological reasons why women are the longer-lived. But it's also possible that men are more subject to the tensions of modern urban life.

Paradoxically, although women live longer than men, they appear to have more illness. In any event, they see the doctor more frequently, even when statistics are adjusted for medical care related to childbirth. Many men still seem to be governed by the philosophy of an earlier age, when it was commonly assumed that an illness did not exist until it was confirmed by medical consultation.

Furthermore, the foundation points out, the demands of their jobs make it more difficult for some men to see a doctor—or serve as an excuse to keep them from seeing one.

NO NEED TO RUSH INTO HEART SURGERY, DOCTOR SAYS

Most operations on children with a hole in the heart can be postponed indefinitely without harmful results, in the opinion of Dr. Benjamin M. Gasul of Cook County Hospital, Chicago. There is seldom an emergency, he says, for nature makes a remarkable adjustment to the defect.

As a result, the operation can be delayed until the child is older and can withstand surgery better. Another advantage in delay is that op-

erative techniques and heart-lung machines will be improved so that the surgical death rate will be much lower than at present.

In the heart condition known as intraventricular septal defect, the mortality rate may run as high as 30 percent in some hospitals. In this condition, there is a hole in the wall separating the two lower chambers of the heart.

To sew up the hole, surgeons must stop the heart, open it, and keep the patient alive with a heart-lung machine. The death rate at present in first-year surgery for this condition is higher than the rate that could be expected if the child were not operated on, Dr. Gasul says.

SURGICAL CONVALESCENCE CAN BE TOO LONG, DOCTOR SAYS

Many patients can go back to work after surgery earlier than they are permitted to, in the belief of Dr. N. Henry Moss of the University of Pennsylvania. They are restricted by their physician who is basing his decision on "opinion" and not objective evidence.

Doctor Moss made a nationwide survey among physicians to determine how long they recommended convalescence following uncomplicated surgery for appendicitis. Some doctors recommended 14 days, while others said they preferred a period of as much as 28 days.

Recent military experience shows that otherwise healthy personnel in the 20 to 29 age group were safely put back on duty after an average of 12 days.

DEODORANT MAY CAUSE SMALL SORES IN ARMPITS

If you use a deodorant in the armpits, be sure it doesn't totally obstruct the sweat glands, warns Dr. Thomas S. Saunders of the University of Oregon. In the last couple of years, several cases of an unusual condition have followed the use of

deodorants, particularly the stick-type containing zirconium salt. The condition consists of small, firm elevated lesions which bear a superficial resemblance to the lesions of tuberculosis. They eventually disappear, Dr. Saunders told the American Academy of Dermatology and Syphilology. But most people who use the stick deodorant have no difficulty.

DIABETES MAY CAUSE TEMPORARY EYE PARALYSIS

Diabetes may be the cause of some cases of sudden paralysis of certain muscles of the eye. Dr. Daniel Snydacker of Chicago says it has long been known that diabetes sometimes involves the third cranial nerve, which controls most of the muscles of the eye. But eye specialists have given little study to the association of diabetes with paralysis of these muscles.

The chief symptom is double vision coming on rather suddenly. The condition improves when the diabetes is under control. Dr. Sny-

dacker says the sudden paralysis may be seen more frequently, since more people are living longer to acquire diabetes and more diabetic patients are living longer with the aid of insulin.

UNDER DRUG INFLUENCE? DON'T DRIVE, SAYS M.D.

People have been well-advised not to drive after drinking. But there are drugs other than alcohol that impair mental, sensory and physical ability, says Dr. Seward E. Miller, University of Michigan.

Patients should not drive: (1) when under the influence of tranquilizing drugs during the initial phase of dosage adjustments; (2) after

having taken such central nervous-system stimulants as benzedrine; (3) when there is dizziness, ringing in the ears, or drowsiness following streptomycin or sulfa drugs; (4) after receiving narcotics, barbiturates and local anesthetics for minor surgery.

It is not enough to drive slowly or carefully, says Dr. Miller, since this kind of driving often constitutes a significant traffic danger, too. People must *never* drive while under the influence of the drugs.

CHROME DRAWN FROM SHOES IRRITATES FEET

When shoes become hard and tend to tear at the seams, it is often perspiration that is causing it, according to skin specialist, Dr. George E. Morris of Long Island Hospital, Boston, Mass.

It happens in this way: Chromium salts are used in most tanning processes to make soft shoe leather. Perspiration draws the chrome out of the leather, leaving the shoe without its chemical protection.

• • •

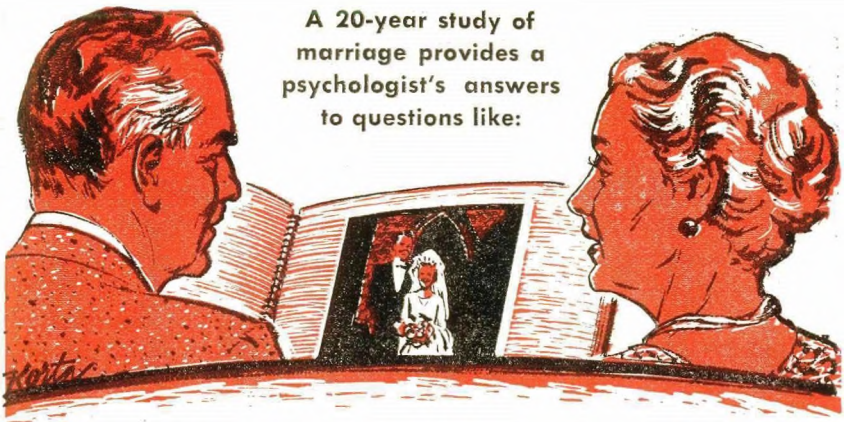
The breakdown in shoes is most often seen in people who are on their feet a great deal, including nurses, waitresses and soldiers.

The "leaching" of the chrome from the shoes by the sweat often causes a rash on the individual's feet, says Dr. Morris. One case treated was a nurse who had suffered from an eruption on her feet for four years. She had solved her problem temporarily by wearing cloth shoes.

INTESTINAL OBSTRUCTION DIAGNOSED BY TAPE RECORDER

By recording the churning sound of the intestines on tape, a Lynchburg, Va., doctor is able to diagnose a number of ailments. Dr. J. W. Devine says a microphone placed on the abdomen will pick up sounds that can be interpreted after special training.

Infection in the early stages, for example, will cause an increase in the churning movements and an increase in the sounds. In the early stages of obstruction, on the other hand, the sounds increase at first, then fade out. Partial obstruction causes one type of sound, complete obstruction another.



Has Marriage Changed You?

by Jack Harrison Pollack

Condensed from The Star Weekly Magazine

WHAT ARE the most dangerous years in marriage? It is popularly believed they are the first or second — after the "moonlight-and-roses" glow has passed. Warnings have also been given regarding the "seven-year itch" and the late 40's and early 50's when many women fear loss of their looks, and men of their virility.

But now an exciting new 20-year study of marriage shows that in the 9th and 10th years happiness is often at a low point. Fortunately, however, by the 20th year of marriage most men and women are as happy as they were right after their honeymoons.

This is one of the many new findings about marriage in a study by E. Lowell Kelly, a University of Michigan psychology professor. A former president of the American Psychological Association, Dr. Kelly started his survey more than 20 years ago. His subjects were 300 New England couples whom he followed from their engagement periods. It is probably the longest continuous study of marriage ever made.

Doctor Kelly found that people generally choose marriage partners who share common ideas about religion, sex, money, politics and children. When a man and woman have different backgrounds, the marital strain is generally greater.

However, persons about to marry shouldn't choose their extreme alikes, either. Instead, they should look for

Toronto Star Weekly Magazine (Nov. 9, '57), Toronto, Ont., Canada.

a delicate balance of differences, the study suggests. In other words, husbands and wives should be alike enough to have common goals but different enough to find each other stimulating.

"I can think of nothing more boring than to come home to my psychological twin," says Dr. Kelly. Dreamy-eyed couples who enter marriage with the "pal" or "let's-share-everything" philosophy often become competitive and forget that marriage requires men and women to play different roles.

Another myth blasted by the study is that grown-ups do not change much in personality. "Good old Charley is the same as he was 20 years ago," or "Mary can never be any different," their friends often sigh. Surprisingly, even most psychologists accept this no-personality-change theory. This explains why so much of their research has been devoted to childhood and adolescence instead of to adulthood.

"In most of us, by the age of 30, the character has set like plaster, and will never soften again," claimed William James, the father of American psychology. [See Science Milestone, Jan. '58 issue.—EDITOR]

But the Michigan marriage study reveals that important changes in our personalities continue to occur during adulthood — even though these changes may be slow and undramatic.

The greatest change found was in religion. Nearly all the men and women had stronger religious feelings after being married 20 years.

Husbands and wives also had a higher regard for marriage as an institution and for raising children after being married 20 years. This was probably due to social pressures.

Most of the women in the study were less interested in art, music, literature and esthetics during their 40's than their 20's. Most men, after two decades of marriage, were less concerned with pure science, philosophy and other theoretical subjects.

Both men and women, who had a mildly favorable attitude toward housekeeping in 1937, developed a definite dislike for it by 1957. One reason is that wives, as well as husbands, grew more "masculine," the study found. Psychologists have long rated us "masculine" or "feminine" by how we think—not how we look. Many of the women in the study, after being married 20 years, thought like presidents of manufacturing companies!

Why? Because today the American home is becoming more mechanized with modern household appliances, explains Dr. Kelly. Today many wives routinely fix electrical plugs, do plumbing repairs and run power mowers.

Another fairly popular belief that the study debunks is that women are more fickle than men. In order to test this old theory Dr. Kelly gave a complex series of personality tests in which he rated women and men consistent or inconsistent in their responses. The most consistent traits found among men and women were those concerned with basic values

and vocational interests. Attitudes and allegiances, ranging from the choice of a cigarette to a political party, changed greatly during the 20 years.

In self-ratings both men and women claimed they were less peppy, less neat, less broad in their interests and less well-tempered than 20 years earlier. However, Dr. Kelly reminds us that people at 45 are more objective in evaluating themselves than before their marriages.

Other scientists have begun interpreting Dr. Kelly's findings. Recently Elliot G. Mishler and Charles F. Westoff, professors at Princeton University, analyzed his data on fertility.

Twenty years ago Dr. Kelly asked each of his engaged men and women subjects how many children they would like. The men wanted an average of 2.6; the women 2.8. Only a slight relationship was found between premarital wishes and actual later childbearing.

Stable, dependable men and women, especially with high energy level, tend to have more children, it was found. Persons who are independent, adventurous, or concerned with their social status generally reproduce less. Women with inferiority feelings, and those who are uncooperative, nervous, selfish, with a wide variety of interests, usually want—and have—fewer children. By contrast, men who are tolerant, unconventional, cooperative, and casual dressers, with broad interests, usually have large families.

Doctor Kelly began his study when he was a 29-year-old psychologist at Connecticut State College. He was amazed at the scant amount of information available on why marriages succeed or fail. With a modest grant from the National Research Council, he set out to discover: what types of men and women marry each other, what individual characteristics make for the happiest marriages, and what changes, if any, take place in husbands' and wives' personalities after being married.

Instead of interviewing long-married or divorced couples who might have forgotten some of their experiences, Dr. Kelly decided to study engaged couples and follow them through their marriages. Picking his subjects from newspaper engagement columns and campus acquaintances, he chose 300 New England couples whom he believed would stick with his study.

At first many of them, fearing embarrassing questions, were hesitant to cooperate. Once the study's scientific purpose was explained, they pitched in enthusiastically. To assure confidential answers, each couple was given a code number. The average age of the men was 25; the women, 24. About 81 percent were Protestant, 11 percent Roman Catholic and 8 percent Jewish.

Doctor Kelly gave all his subjects seven standard psychological tests, including a 36-question personality test that he himself devised. The couples rated themselves and each other, then five friends of both were asked to do likewise. This gave farsighted Dr. Kelly ten additional

sources of information about his couples. All 600 promised to fill out individually an annual follow-up questionnaire about their marriages which would be sent to them on their wedding anniversaries.

World War II temporarily halted the study. After the war, naval Commander Kelly, now demobilized, accepted a psychology professorship at the University of Michigan and resumed his study with the aid of Michigan and Yale grants.

Fellow psychologists gloomily predicted that the war-dislocation of families would prevent him from recontacting many of his subjects. Tracking down the last few couples was as thrilling as a detective manhunt, but investigator Kelly found that, after nearly 20 years, 454 of his original 600 engaged persons were still living as husband and wife. Though all had originally lived in New England, now they were in 31 states, in Canada and in several foreign countries.

With such widely scattered subjects, the follow-up had to be done by mail.

"This was an exciting period," admits Dr. Kelly. "Would our participants nearly 20 years later, busy with their jobs, children, hobbies, and community activities, take the time to fill out these forms again?"

They did and their replies were amazingly frank. Many topics, including finances, sexual relations, children's upbringing and philosophy of married life, have yet to be analyzed. After the voluminous data has been tabulated on electronic computers by his assistants, Dr. Kelly intends to publish a book.

Ever since Adam basked in Eve's seductive smiles, philosophers, scientists and ordinary men and women have been seeking the formula for happy mating. Perhaps the findings of Dr. Kelly will throw new light upon the world's oldest relationship —and help future generations make greater successes of their marriages.

"Hard Core" of Atom Defies Understanding

THE UNEXPLORED INTERIORS of atomic nuclei are growing smaller and smaller, but there still remains a "hard core" resistant to the most powerful probes.

A three-layer picture of the nucleus was being drawn by physicists attending a Stanford conference on nuclear sizes and density. Scientists now understand the reactions of the outer fringes of the nucleus, both theoretically and experimentally.

The intermediate zone is being penetrated, but effects there are still somewhat puzzling, experimental results not always agreeing with theory and vice versa.

Deep in the nucleus' interior is the "hard core," which so far defies science.

Physicists once considered the entire nucleus as an extremely tiny but impenetrable mass. By hurling such fragments of matter as electrons and protons at atomic nuclei, scientists have learned the nucleus is soft and fuzzy.

Mongoloid Children Want To Love And Be Loved

HELP FOR THE "UNFINISHED" CHILD

by James A. Brussel, M.D.

Condensed from Today's Health

MUCH IS KNOWN and written about mental deficiency, but the same cannot be said for the form called mongolism. This clinical type of mental retardation was first described by J. Langdon Down in 1866. Shuttleworth referred to the patients as "unfinished children," for they appear to retain many remnants of the fetal stage of development. Mentally they are usually of the idiot or imbecile level—that is, with an IQ below 25 in the former and between 25 and 49 in the latter. The severity of the retardation can be judged when we consider that an IQ of 70 is "borderline intelligence."

But taken as a whole, these children are conspicuously alert and bright for their mental age level, remarkable imitators, and—here is the real tug at their mothers' hearts—usually a happy, contented, active group.

Physically, they share a common facial appearance suggesting—though actually not much like—the Mongols, hence the name. Walk through a large ward in a state school housing these children and you would think they were brothers and sisters! This applies equally to the out-and-out, clear-cut clinical type, the mongol, and the patient who has less severe characteristics and is classified as mongoloid ("like" a mongol).

The skull is rounded, brachycephalic ("short head") and flattened at the back. The eyelid fissures are narrow and slanted in and downward toward the nose. The ears are often large, flaring and poorly patterned. The bridge of the nose is flattened and underdeveloped.

The tongue is thick, somewhat enlarged, and deeply fissured. The arch of the palate is low and broad, with the teeth commonly showing enamel defects, often peg-shaped, and widely spaced. Eruption of the secondary teeth is much delayed.

Hands are broad with short, tapering fingers, and the feet are paddle-shaped, with a decided gap between the first and second toes. Ligaments

Today's Health (Dec. '57). Copyright 1957 by the American Medical Association, 535 N. Dearborn St., Chicago 10, Ill.

are extremely lax and all joints can be greatly overextended.

Anything but the mildest sort of weather provokes a profuse nasal discharge and a roughening, thickening and reddening of the hands with a glove-shape distribution, unless unusual care is taken.

Many explanations as to cause have been advanced, especially by geneticists, but all theories remain unprovable. Mongolism exempts no family because of color, nationality, creed, social or economic status. Time after time, in hundreds of families with a mongoloid child, it has been possible to trace back family trees and discover not only no mongolism or mental deficiency, but nothing except robust, vigorously healthy ancestors for several generations.

Until very recent times much significance was attached to the supposed frequency of such children being born to mothers approaching the menopause, or as the last-born in large families. Today we know that young mothers also produce mongols and mongoloids, and that these babies may appear first or second or at any time in large families.

How many such children are there? Since the very slightly afflicted can pass unnoticed, statistics are inadequate. However, in the severer forms, some idea can be gathered by regarding the latest figures from one locality. New York State completed an intensive survey which revealed 165,000 persons in the "severely retarded" category (idiots and imbeciles), or about 1 percent of the state's total population! In New York City alone there are 3,000 births in this group *each year*. How many more mentally defective babies are born annually, including the less retarded and therefore less readily recognized moron and low normal, can only be a matter of speculation.

For a long time psychiatrists and educators had an excuse for offering little if anything in the way of treatment, for then these children rarely lived beyond their first few years, because of their abnormal tendency to contract infections.

Now, thanks to antibiotics, the infants are surviving childhood and later years. Fifteen years ago state schools had crib after crib of mongoloid infants but a mere handful of mongoloid children. Today, wards are overflowing with such youngsters and adults.

Now for the first time, however, science can study retarded individuals, assay and inventory their assets and at least by trial and error discover what sort of care and training will produce the best results.

Medicine has already learned much. First, the task is not hopeless, particularly for the mongoloid. Patient, sympathetic but persistent discipline can help this type of retarded child to acquire good personal hygiene, to dress and undress, to be reasonably neat and tidy, to talk and walk and eat properly. In not a few instances, these children can attend special schools and create more than simple products in occupational therapy centers. In recreation they can learn to master simple games

and to participate in group activities with rather astonishing cooperation.

People who have dedicated their professional lives to helping the mongols will tell you that their work is a pleasure and a source of deep, warm satisfaction because "these lovable children want to love and be loved."

Years ago I learned to avoid pointing a finger at a mongoloid child or stroking his head because that finger will be clutched and held as though the child's life depended on it, and when those pathetic eyes are turned up to you with an appealing smile, you just cannot withdraw. If any one group of human beings can be singled out for their frank, undisguised affection, they are undoubtedly the mongoloids.

• What could be bolder than the dream that we shall yet trace in the structure of matter itself the compelling reasons which formed it, step by step, into a shape which one day came to life.
—J. Bronowski

Seldom does a day pass without some mother who has given birth to a mongol or mongoloid asking me, "Doctor, should I have another child? What are the chances that this will occur again?" These mothers have been told everything from "there isn't any likelihood" to "under no circumstances should you become pregnant again."

As near as current statistics can determine, the chances for a mother producing a second mongolian child is 50 percent. If this reads like terrific odds, let me cite two typical instances. After one couple had placed their first-born, a mongolian idiot, in a state school, they telephoned me about a month later that both of them were depressed to the point of contemplating double suicide. I invited them to my office and as we talked I asked if they were considering another child.

Wide-eyed and horror-struck, they gasped a vehement rejection of the idea, solely on the grounds that they could never face another such occurrence. I asked them what they would say to themselves 20 years after when they would inevitably wonder if they might have had a normal child.

Furthermore, I argued, they had done all they could for their first-born and, should it happen again, they could do the same again. I talked with them for over an hour and when they left I felt that though I had done my best I had made little impression.

A year later I received a birth announcement. I promptly telephoned the father and asked him if the second child was normal.

"Oh, yes," he crowed, "but, doctor, I must tell you that the baby was born three months ago. We wanted to be sure before we notified you." And after a brief pause, "We won't have to wait 20 years for the answer to that question, will we?"

Then there was the mother of two normal children whose third child was a mongolian idiot. Undaunted, she had another child, and this, too was mongoloid. "If I was able to produce two normal children, doctor," she said, "I should be able to do it again." On the fifth try she did.

There is an unfortunate miscon-

ception about the institutionalization of mongolian infants. Most people, including many physicians, seem to believe that prompt hospitalization of the newborn mongoloid is an irrefutable must. Of course, such a baby may suffer complications such as malformations of the heart, hydrocephalus or congenital cleft of the vertebra or skull. Feeding or nursing problems or convulsions may also require that the baby be removed from the home and placed where the facilities for treatment are available.

Of the dozens upon dozens of mothers who have sought placement of their mongoloid babies I have seldom had one fail to ask, "Doctor, *must* I give up my baby?" Where the child presents no clinical problem other than mongolism I answer in the negative. No amount of money, no nurse, attendant home, school, institution or hospital can possibly buy or substitute for a mother's love.

Whenever the mother asks if she must part with her baby I inquire why she is seeking placement. Then comes the inevitable answer, "My doctor advised me." Or "I was told it would make a nervous wreck of me," or "The baby would have an unfavorable influence on my other children."

I should like to answer these questions more realistically:

1. How can caring for a mongoloid infant "make a nervous wreck out of its mother"? If the case is uncomplicated, *the care of a mongolian baby is no different than that of a normal baby!*

2. "The other children will hate it . . . or tease it . . . or hurt it," and so on. Mother, the other children will act toward that mongolian infant *exactly as you do.* If you are kind, sympathetic, loving, and protective, so will they be. On what valid psychological grounds can children be expected to be jealous of a subnormal defenseless sibling? Why should they mistreat a brother or sister who lacks normal intelligence, physical ability and coordination?

The pattern is the same in all areas. If you despise religion, so will your children. If you like ice-skating, so will your children. If you love your unfortunate little mongolian baby, *so will your children.* And they will quickly teach their comrades in the community to act the same way toward their baby brother or sister.

On the basis of this philosophy and what we are beginning to learn, it seems that help and instruction for parents, not institutionalization of the baby is desirable. In many communities private and public agencies are now planning for day-care centers where mothers can take their mongoloid children and learn special techniques in caring for and teaching them, while the children themselves are undergoing training and education by expert personnel.

Finally there is "public opinion." Horror, repugnance and intolerance are more rampant than I had heretofore suspected. Recently I heard two educated women remark, while watching a marvelous TV presentation on mental retardation, "Why don't they kill these children at birth,

spare them handicaps of struggling for existence, spare their parents all the anguish and bitterness they must feel?"

Overlooking the fact that these ladies were childless, and the religio-socio-legal question of so-called "mercy killing," we must bear in mind that study and research of the living mongoloid may lead to the prevention of mongolian births in the future.

Finally, watch an understanding mother and her retarded baby. Note the loving look in her eyes and, more, the sheer adoration in his. Remember, in *any* case of *any* handicapped child: *Somebody loves him!*

Death Rate Rose Slightly in 1957

THE DEATH RATE in the United States increased moderately in 1957, according to the statisticians of the Metropolitan Life Insurance Co. This increase largely reflected the outbreak of Asian flu.

The national death rate for 1957 is estimated to be 9.6 per 1,000 population, compared with 9.4 for 1956. It is the tenth year in succession to record a rate below 10 per 1,000.

Although the case fatality rate for respiratory diseases has been relatively low, the death rate from influenza and pneumonia as a group increased in 1957, rising to about 34 per 100,000. This is the highest rate in about a decade, but less than half that recorded in any year prior to 1941. In sharp contrast to the influenza pandemic of 1918-19, the excess mortality resulting from the recent outbreak was concentrated among people past age 55.

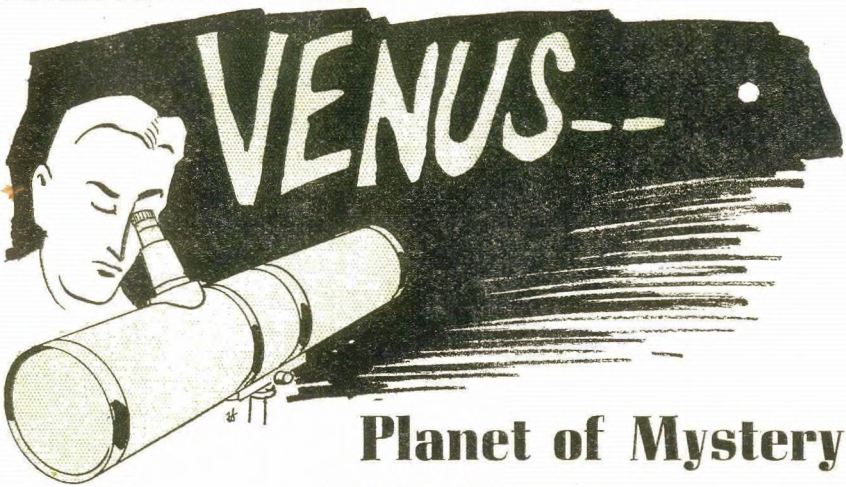
There was a marked reduction in cases of poliomyelitis. About 6,000 cases of the disease were reported in the U.S. during 1957. This compares with more than 15,000 cases reported in 1956, about 29,000 in 1955, and with nearly 58,000 in 1952. The low level of cases in 1957 resulted partly from the wide use of the Salk vaccine, the statisticians report.

Deaths from tuberculosis also decreased. It is likely that in 1957 for the first time, the death rate from the disease in our country will fall below 8 per 100,000 population. In the past decade alone the tuberculosis death rate has dropped about 75 percent.

Infant and maternal mortality in 1957 continued at the all-time low levels established the year before. There were about 26 infant deaths for every 1,000 live births, which represents a decrease of about 20 percent in the past decade and of more than 50 percent in two decades. Maternal mortality has been reduced by almost three-fourths since 1947.

Fewer cases were reported in 1957 than in 1956 for each of the principal communicable diseases of childhood (measles, scarlet fever, whooping cough, and diphtheria). For the group as a whole, the decrease was one-fifth. Parallel declines were recorded for cases of typhoid fever and infectious hepatitis.

Recent scientific findings throw new light on



Planet of Mystery

by Patrick Moore

Condensed from The New Scientist

THE LAUNCHING of artificial satellites has opened a new era in exploration of the universe. Soviet scientists have said that attempts to send unmanned vehicles to the moon and nearer planets will be made before long, and one of them has even stated that the time is near when man will set foot on Mars and Venus.

Of these two worlds, Mars appears the more promising. Maps of its surface can be drawn up, and its temperatures measured. Though conditions there are hostile, they are not hopelessly so, and many astronomers believe that the dark areas are due to vegetation, though as yet there is no proof.

On the other hand, we know very little about Venus. This is shown by the fact that of two theories now being seriously discussed, one proposes that the surface is covered entirely with water, while the other indicates that there is no water at all!

This lack of information may seem curious, since Venus can approach us to within a distance of 25 million miles. This is less than that of any other planet, and only about 100 times the distance of the moon. Unfortunately, Venus is quite unobservable except on the rare occasions when it passes across the sun.

In dimensions and mass, Venus is very similar to the earth; the diameter is 7,700 miles, the mass 0.83 of that of our world. Here, however, the similarity ends; the atmosphere and the surface conditions are quite unlike those of the earth.

When Venus is observed by tele-

scope, the disk usually appears more or less blank. Even large instruments will not show much, and the cause is obvious enough: what we are seeing is not the actual surface of the planet, but merely the upper part of an atmosphere. Most photographs are devoid of detail. Even a photograph taken with the Palomar 200-inch reflector shows nothing at all apart from the bright crescent.

Features on the disk can be seen from time to time, but take the form of very faint and ill-defined gray shadings and brighter areas, quite unlike the definite details visible on Mars or Jupiter.

One of the problems of Venus concerns the length of its rotation period, or "day," which is still not known. Attempts have been made to get information by measuring the apparent shifts of the gray shadings. Unfortunately the shadings themselves are not permanent, and have no definite boundaries. Even if such shifts could be measured we would still have no definite clue to the rotation period; local movements in the atmosphere of Venus would play an important part. The bright patches seen occasionally are no more informative.

Of greater interest are the light areas often seen near the "poles" of the planet. These areas are often termed polar caps, but they are certainly not due to ice or snow, and they may not even mark the poles of rotation. Some authorities dismiss them as mere contrast effects. If they are real, they can only be phenomena of the upper atmosphere of Venus.

Everyone must be familiar with the appearance known as "the old moon in the new moon's arms." When the moon is a crescent, the "dark" side can often be seen shining faintly, because it is lit by light sent to it from the earth. A similar effect has been seen with Venus, but is much more difficult to explain, particularly as Venus has no satellite. This "ashen light" is elusive and hard to study, but work carried out by Russian astronomers seems to show that it is a real phenomenon.

It would be interesting to find out something about the magnetic field of Venus, and studies have been carried out by J. Houtgast, of Utrecht, Holland. If Venus has a powerful magnetic field, then when the planet is between the earth and the sun it should divert parts of the streams of electrically charged particles emitted by the sun. From his studies, Houtgast has suggested that Venus has a magnetic field considerably more powerful than our own. Here again, the results are still tentative.

Ordinary photographs of Venus show no detail. Photographs taken in ultraviolet light do, however, show definite surface markings, and this confirms that what we are studying is not the real surface, but merely the

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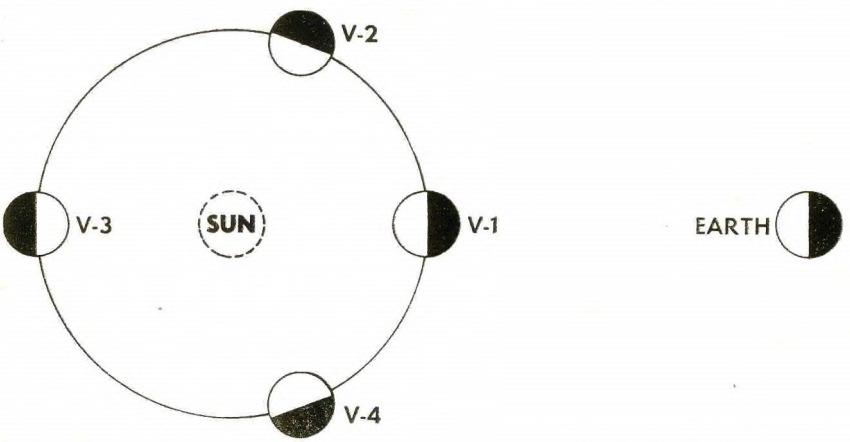
upper part of Venus's atmosphere.

Telescopic work carried out by G. Schiaparelli in 1877 led him to conclude that Venus, like Mercury, has an axial rotation period of the same length as the time taken for the planet to go once around the sun—in the case of Venus, 224 days 16 hours 49 minutes. Since Venus's orbit is almost circular, this would mean that the same face would be turned towards the sun all the time, and "day" and "night" in the conventional sense would be unknown there. In this case, we would expect the sunlit hemisphere to be much warmer than the dark side of the planet.

But this is not what we find. Measurements show that the two hemispheres are each at a temperature of



ABOVE, the phases of Venus (assuming, for simplification, the earth to be stationary) related (below) to how it appears to us. At V-1 Venus appears at its nearest and largest, but its darkened side is presented to us (below, left). At V-3 the planet is at its most distant, but is fully illuminated by the sun (below, right). The other drawings show how Venus appears in the intermediate stages when viewed through a telescope.

about —39 degrees Centigrade. It is true that the temperatures refer to the upper atmosphere, not to the surface; but it is now believed that on Venus, the "day" is decidedly shorter than the "year."

Doctor Gerard Kuiper, of the Yerkes Observatory, University of Chicago, from photographic studies, prefers a rotation period of about one terrestrial month, and until recently this was the value generally accepted—but recent work by radio astronomers has thrown the whole question into the melting-pot again.

In early 1956 J. D. Kraus, at Ohio State University, detected radiation from Venus on a wavelength of 11 meters. The signals were of two kinds. The first took the form of very short bursts, rather like atmospherics from thunderstorms; the second were more sustained, lasting for one second or even more, and were faintly reminiscent of signals from a radio telegraph station — though it is hardly likely that "Venusians" were trying to attract our attention, as was suggested in sensational newspaper reports at the time!

Venus may well have an ionosphere as dense as that of the earth. If so, radio waves originating near the planet's surface will more readily penetrate the ionosphere of Venus near the apparent central point of the disk; in fact, the ionosphere will seem to have a "hole," which will remain fixed relative to the earth. As Venus rotates, the radio sources will be carried periodically beneath the "hole," and will then be best observed. In this way Kraus has derived a rotation period of 22 hours 17 minutes, not very different from our own.

Since Venus is so like the earth in size and mass, we might expect a similar atmosphere, but analysis of the upper layers has shown that this is certainly not the case. No oxygen or water vapor has been found, but there is a great deal of carbon dioxide, CO_2. Coupled with the lesser distance of Venus from the sun this indicates an uncomfortably high surface temperature, and radio observations lead to the same conclusion.

It is clear that the atmosphere of Venus is hopelessly unfavorable for advanced life, but there is no general agreement as to the nature of the "clouds." These clouds are yellowish, and are probably in violent motion. They may be due largely to dust, but this view has been challenged by F. L. Whipple and D. H. Menzel, both of Harvard College Observatory, who consider that they are due more probably to H_2O.

Whipple and Menzel point out that in view of the low temperature of the upper atmosphere of Venus, failure to detect water vapor is no argument against the H_2O character of the clouds. A thick atmosphere consisting largely of CO_2, could not exist on an earthlike planet with continents protruding from oceans of water; the CO_2 would be "fixed" in the rocks in the form of carbonates.

On the other hand, if land masses were absent, the fixation of CO_2 would not continue after the formation of a thin buffer layer of carbonates. It is therefore suggested

that the surface of Venus is completely covered with water.

Forty years ago, it was believed that Venus might be a world in a condition similar to that of the earth in carboniferous times, with abundant moisture, luxuriant vegetation, and amphibian or even reptile life.

Analysis of the atmosphere showed that this theory could not be correct, and it was superseded by a new picture of Venus, according to which the whole planet was a dust-desert without a scrap of moisture.

Now we have the marine theory, which has been strongly criticized, but which is certainly worth most serious consideration.

One thing is certain: Venus is a thoroughly unfriendly world, and the existence of advanced life there seems to be utterly out of the question. But in all other respects, it is best to admit that we do not know.

Though few people now doubt that men will one day land on Venus, we cannot yet predict what the first space travelers are likely to find.

Heart Beats Irregularly for 38 Years

THE IRREGULAR BEATING of a person's heart at frequent intervals — or even constantly—doesn't mean he's going to have a heart attack and die.

In fact, one New Yorker's heart beat irregularly for 38 years before he suddenly died at the age of 94, "having been most active until the very last moment," a New York doctor reported.

He was suffering from auricular fibrillation, which is a convulsive movement of the upper chambers of the heart. His was the familial type.

He was one of 22 members of the same family, all of whom had auricular fibrillation. The family's history, covering 36 years and 113 members of 5 generations, was outlined by Dr. William L. Gould. Albany, N. Y., in the *Archives of Internal Medicine*.

The first two cases occurred in a stepbrother and a stepsister. Eight members of the second generation who lived to the sixth decade or beyond, all developed auricular fibrillation. In the third generation, 11 cases have already developed and more may appear from time to time, Dr. Gould said. Only one case has appeared in the fourth generation—in a 32-year-old man, who is the youngest one to have the condition. So far the fifth generation is too young to show signs of the disorder.

Treatment for the disorder is generally very simple. Posture changes sometimes help during the attacks. When drugs are needed, barbiturates are better than digitalis, quinidine or nitroglycerin, which are usually given in ordinary auricular fibrillation.

The patient should continue his usual routine, Dr. Gould said. He is not a "cardiac-failure patient"; in fact, familial auricular fibrillation does not even predispose the patient to cardiac failure. Only 1 person among the 113 studied died of a coronary attack; he had had rheumatic fever in childhood.

SCIENCE LOOKS AHEAD TO 2000 A. D.

by H. J. Rand

President,
Rand Development Corporation

Condensed from Think Magazine

WHEN a development engineer like myself looks into the future and tries to explain what he sees, he begins to sound more like a science-fiction writer than a development engineer.

By the year 2000, for instance, it is entirely possible that we may have spaceships which can travel at a speed approaching the speed of light. This would put us in a position to examine some of the fantastic implications of Einstein's theories. These theories indicate, among other things, that as man soars through the air at the speed of light, his life processes slow down to the point where he might go off into space for what seems like a day in his own experience and find, on his return to earth, that 1,000 years of life had elapsed.

But we need not search so far afield for technological adventures. Our own times are amazing enough, and they are becoming rapidly more so as we move toward the end of the century. Progress today does not follow a straight upward curve, in the 19th century way; rather, it is exploding all around us.

In energy consumption, for example, half of all the oil consumed in the history of man has been consumed in just the last 25 years. One Strategic Air Command bomber consumes more fuel in one mission than most of our entire Air Force consumed in 1918.

The SAC can drop in a single raid more explosive power than was expended in all of World War II, both on the ground and in the air, by all armies, navies and air forces. By 2000 A.D., what remains of cheap fossil fuels, such as oil, coal and natural gas, will be limited; hydroelectric power will have been utilized to the maximum; and atomic energy will be commonplace as a substitute for the older sources of energy.

The development of aircraft also illustrates the accelerating progress which characterizes today's technology, and will continue to do so as we approach the year 2000. In its first 50 years the airplane picked up speed rather slowly, reaching a little over 100 miles per hour in 1918,

doubling its speed in approximately double its life, then rising to 300 mph in 1936 and 600 mph in 1954. The current speed record is over 2,000 mph, but rockets which might be manned in the near future have exceeded 19,000 mph.

As for materials, the aircraft manufacturers started out with fabric and wood, then gradually took advantage of the newer aluminum. Now we are in the new era of titanium — an era only about ten years old. And already we are using high-temperature steels and can see the widespread use of high-temperature plastics, which have the advantage of low heat conductivity.

In our flights into space, exit from and re-entry into the earth's atmosphere imposes a severe strain on the structure of aircraft. Although plastics do char under such circumstances, their low heat conductivity allows only outer layers to be destroyed, leaving the basic structure intact.

It is clear that a revolution in metals is just starting and that the remaining years of the century will see startling advances in steel, aluminum, copper and other basic metals, as well as the birth of many new metals and metal alloys.

And, although plastics have undergone tremendous advances in the last 50 years, they are still in their infancy and their future holds untold wonders, including plastics that will be nearly as strong as steel. We are now seeing the emergence of engineered plastics, which have the properties of several materials in a composite form. A good example of this is reinforced fiber glass. The tremendous strength of glass fibers is combined with polyester or other resins to protect the fragile glass fibers from shattering.

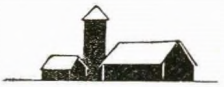
Beyond that, I think we can expect to see the development of an industry utilizing inorganic fibers other than glass in heat-resistant uses. By 2000 A.D., we can expect to see a whole new family of materials now unknown to man or even to nature.

These will be brought into being by processes such as that used by the General Electric Co. to produce synthetic diamonds. The tremendous heat and pressure utilized in this process change the crystal structure of boron nitride into a diamond structure. The new structure is as hard as a diamond and has the additional advantage of being able to withstand about twice as much heat as a natural diamond.

One of the most dramatic areas in our future, I believe, will lie in our fast increasing ability to solve mathematical, engineering and scientific problems with the help of electronic computers. Computers and photoelectric sensing devices are the keys to man's ability to grapple suc-

cessfully with the technological revolution which he is creating.

Already great strides have been made in running complex machines by the use of magnetic-taped instructions. We can now machine complicated parts to tolerances closer than any heretofore possible and repeat the operation indefinitely by capturing the instructions to the milling machines on magnetic tape. These machines surpass even our most skilled machinists in their various repetitive skills.



As the population grows and the demand for food increases, we can expect computer and photoelectric sensing devices (plus programming on magnetic tapes) which will allow men to cultivate, plow, sow and reap in several fields at the same time with merely supervisory monitoring of the activity.

A farmer, for example, will be able to sit at the console of a television receiver and keep track of machines in half a dozen fields unattended by any human hands except the ones that control the electronic equipment.

In other ways, too, science is working toward solution of the big food problem that will be presented by the growing population. Already in the United States, refuse waters from paper production are being utilized for human consumption. By 2000 A.D. we will be processing other waste and sewage materials in elaborate ways for a variety of human uses.

As an indirect result of atomic fusion (the control of the hydrogen bomb reaction), our food supply may be changed even more drastically. It is believed by many that work on controlled atomic fusion now is at the same stage of development that atomic fission was in 1940. The theory, in other words, has been worked out; what remains is the practical application. What we will have to learn is how to control temperatures of approximately 100 million degrees.

Some German scientists believe that the problem can be solved by means of electromagnetic fields which will hold the hydrogen reacting atoms in the center of a large pipe. The necessary isotopes for this reaction might be obtained from the sea. Some think that a cubic mile of sea water contains enough of these isotopes to supply the world's annual energy requirements in 2000 A.D.

If this is so and is done, we will have to change our whole concept of life. It means that we will be mining the sea instead of the land. Since we will have to process this large amount of water—one cubic mile—we will be able to extract the gold, silver, iodine, bromine, tungsten and magnesium which we are already extracting, plus all of its other rich contents.

And we will probably be farming

the sea as well, growing foods that are not even thought of now, such as unicellular animals and plants. This would make available adequate food for our expanding population for at least a century.

We are all aware of the great strides that have been taken in chemistry since 1900. Our great chemical plants produce compounds which seem like sheer magic. Our ability to construct such new materials as nylon is impressive. But the chemical industry's advances in the next 40 years will make those of the last 40 look quite ordinary. The sea will be turned into hundreds of valuable chemicals as the air now is. New fibers, new finishes, new materials of all kinds will come from the laboratories, affecting everything we eat, wear and use.

In manufacturing, as we look back to 1900, we see an enormous increase in investment in tools to increase the productivity of workers. The investment which we now make can be expected to increase heavily by 2000 A.D. We can expect that the investment per worker in automatic tools will increase at an astronomical rate.

Our forms of transportation are more difficult to predict. Since 1900 we have been building up an enormous problem in traffic control. It is my belief that most of the long-range transportation of goods and materials in the year 2000 will be done by unmanned space vehicles automatically and safely controlled from origin to destination along predetermined and non-interfering spaceways.

There is one prediction which, for better or for worse, seems certain to hold for the year 2000. Children born now will have reached the age of 43; they will look about the same and act about the same as people do now; they will have powers over nature undreamed of today, but their power over themselves and their fellow men will present about the same problems they do today.

Hospital Patients Get Musical Pillows

LISTENING TO A PILLOW is the way patients are now passing the time at the North Cambridgeshire Hospital at Wisbeth, England.

The pillows contain a new device called the "pillowphone" which brings the patients recorded or "live" music and can also be used to call the nurse by speaking into it.

The pillowphone is a loudspeaker which has been encased in sponge rubber covered with a washable plastic. Neat and hygienic, it can be put either underneath or on top of the pillow.

When he wants to talk to the nurse, the patient merely pushes a button pinned to his blanket and waits until a little light flashes. This signals that the nurse is listening, and he can begin talking to her through the pillow.

If you have sought the repair of a household appliance lately you, too, may have wondered . . .

Is There a Handyman Handy?

by Francis Coughlin

Condensed from the Chicago Sunday Tribune Magazine

WHAT THIS COUNTRY NEEDS considerably more than a good 5-cent cigar (current cost about a quarter) is a good $5-handyman (former cost about a dollar).

Come to think of it, a reasonably competent apprentice will do, provided he is able, say, to resolder a cuff link, to restore a sagging set of bedsprings, and to effect simple repairs on standard electrical appliances.

My present technological needs are small. I am in need, at the moment, of a handyman to resolder a cuff link. The link of which I speak is of no great value. It happens to have been fashioned by a friend of mine who designs handmade jewelry. The motif is a fish—or, more precisely, the skeleton of a fish. That gives you the idea. The little metal bar joining the gadget came unsoldered. Probably it was my fault.

I first consulted an attendant in a hardware store — high school type, clean-cut, American lad, other-directed personality. Result, negative. Pertinent comment: "Nah, we wouldn't bother with nothin' like that. Maybe a jeweler . . ."

First Jeweler: "Mister, you got here the work of some screwball. Lemme sell you a real set of cuff links. Two television cameras with the initials engraved. Fifteen dollars—"

Second Jeweler: "I dunno. I'd have to send it to the shop, and all that trouble. Why don't you forget it?"

Third Jeweler (Columbus viewing

the New World): "You know what? This thing's come unsoldered! I guess maybe I can find some silver solder around. Come back a week from Thursday."

I came back on the day appointed. The cuff link came apart the following day. I am still in need of a man to resolder a cuff link.

I AM IN NEED also of a fellow to replace two broken slats in the box-spring frame of a single bed. I cannot easily send the bulky frame back to the manufacturer. I am indisposed toward wrestling with coiled steel and splintery soft woods. (Why soft woods, anyway, in a $40 item?)

The question is: Do I call a carpenter, a cabinet maker, or an upholsterer? The notion seems as ridiculous as to call a brain surgeon to look after a blackhead. In any case, I shall need the services of a small lumber yard. I do not have a lumber yard on the premises.

It may be that broken cuff links and collapsed bed slats pose exceptional problems. But surely electrical appliances are familiar household marvels. I don't refer to complicated mechanisms. I know that refrigerators, washing machines, television sets, and vacuum cleaners are as intricate as sputniks.

Skill, knowledge, special equipment, and extra-special training which are the glories of our free enterprise system are needed to effect major repairs. Not that electrical servicing is free, you understand. The blunt fact is that servicing costs are higher than the original cost of many a triumph of American know-how and easy-credit merchandising.

Now I would not, for the world, impugn the zeal and talents of the young men who man our repair shops. They are bland, well-laundered, outgoing, and highly vocal young people. Doubtless they have completed high school courses in life adjustment and folk dancing with spendid marks.

My sole cavil is that they don't seem to understand the simplest things about the little routine jobs they're commissioned to do. They are ignorant, careless, and incompetent. They are deficient in elementary knowledge, slapdash, or stupid in workmanship. They do not *know*. They do not *do*. They do not *care*.

IF THIS SEEMS an irate indictment, I ask you: Have you sought the repair of a household appliance lately? I have. May I append these few footnotes from actual clinical histories?

Case of the Coffee Maker: This intelligent mechanism, personally known to me, suffered a sudden collapse of its vital functions. To be sure, the final failure was not its first. A cord had to be replaced once. A socket burned out twice. Interior maladjustments were repaired at the factory on still another occasion. (Chronic invalidism?)

Minor surgery was performed by local practitioners and a versatile janitor. The final emergency necessitated a prolonged stay in a large public utilities clinic. Recovery was

uneventful except that a metal filter, also admitted to the clinic, was never formally received and, therefore, never formally discharged. (Faulty administration?) Total time incapacitated — including the period of waiting for a new filter—one month and four days.

Electric Sheet: This affectionate bed-covering of my acquaintance was hospitalized at the first symptoms of a profound dyscrasia and subsequently pronounced on the point of cure six times—each time following a family visit. Residents and interns were completely baffled by the patient's indisposition. Finally the chief-of-staff took the case. Cure established—friends and relatives hope.

Steam Iron: Disturbed, uncooperative; apparently a psychotic individual. Two weeks of clinical consultation have resulted in neither diagnosis nor prognosis.

Twin Lamps: Wiring defective, apparently congenital. Wiring reinstalled. Standing fixtures wobbly. Patients and family: making a tolerant adjustment.

Three-way Switch: Burned out. Blew fuse. Pronounced inseparable. New switch, more expensive, on probation.

WELL, these are five clinical cases. Nothing as complicated as sputnik, either. It is sobering to reflect that some 2 million repair and maintenance men operate under our economy. It is distressing to record that our national repair bill exceeds $16.5 billion a year — more than the cost of American home furnishings and clothing for the same period.

Yet perhaps this essay sheds light on what happened to *our* sputnik. It's quite likely the satellite was developed two years ago. The final gadgets needed were one switch, two fuses, and a 15-watt bulb. The satellite was sent to the nearest electric appliance repair counter. That's all. We started from scratch and built a new satellite.

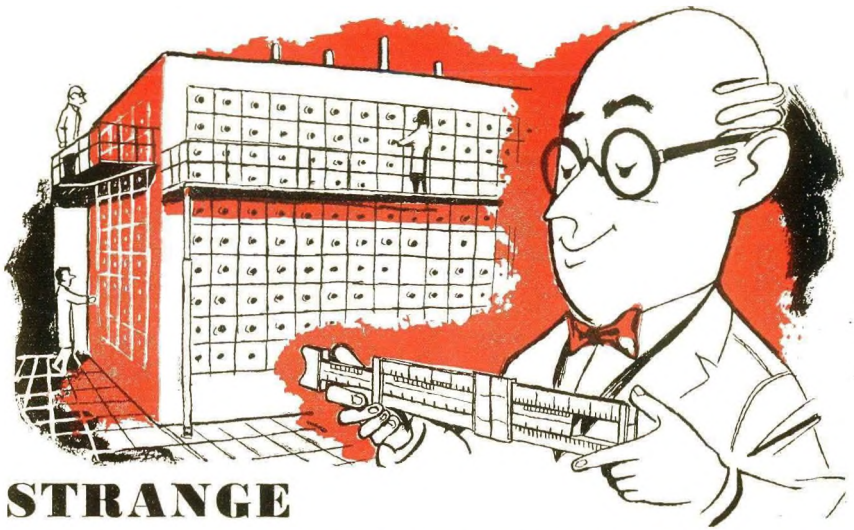
Average American Is a Little Fat

ALTHOUGH too much emphasis has been put on overweight as the direct cause of coronary heart disease, the indirect relationship between the two conditions is even greater than many studies have indicated, Dr. Richard S. Gubner, Equitable Life Assurance Society of the U.S., New York, N. Y., reported in *Nutrition Reviews*.

Statistical studies that show little difference between overweight people and the so-called average-weight ones, as far as life span and heart disease go, are misleading. There is quite a difference when overweight people are compared with those who are underweight.

The "average" adult American is in fact moderately obese, with fat making up some 20 percent above the lean, fat-free, body weight of the average middle-aged male.

When moderately underweight individuals were compared with moderate overweights the death rate climbed steadily as the overweight increased, Dr. Gubner said.



STRANGE PARTICLES IN THE ATOM

by Hoke Norris

Condensed from The Chicago Sun-Times

TWO BILLIARD BALLS have collided and separated, changing their directions. If the balls are reversed, as in a motion picture run backward, will they retrace their paths?

This problem and others like it arise out of the work which recently won the Nobel Prize in physics for two Chinese-born University of Chicago graduates, Tsung Dao Lee and Chen Ning Yang.

They questioned a principle of physics accepted for 30 years—the principle of the conservation of parity, which was supposed to rule in all forms of matter and energy.

Their questions prompted continuing experiments at the Bureau of Standards, Columbia University, the University of Chicago under Associate Prof. of physics V. L. Telegdi, and by C. Roy Ringo, associate physicist at Argonne National Laboratory, and his associates.

A new secret of matter is being studied. The scientists believe they have demonstrated that parity conservation does not always operate. There are some forces which disobey the law that applies to other parts of the universe. What is the significance of this hole in nature? That's what they're trying to find out. The answers may relate to the very nature of matter.

To understand the meaning and significance of these developments, the investigator refers to four forces operating throughout nature.

1. The first and weakest force is

gravitation, which was explained by Newton.

2. Then came electricity, or electromagnetism.

3. Third was the nuclear force holding the nucleus of the atom together. By all the rules of physics and logic, the nucleus should fly apart with explosive consequences, for its charged particles are all plus. Like is supposed to repel like, as when the positive ends of two magnets approach each other. The plus charges in the nucleus should send it flying apart.

The nuclear explosion is the release of the force that binds the nucleus together. It is the force that devastated Hiroshima and Nagasaki.

4. The fourth force is the one involved in the parity-conservation experiments. "This," Ringo said, "has long been one of the thorniest businesses in nuclear physics." It's known as beta decay, or weak interaction. It describes the emission of particles by other particles in the atom.

The components of the atom may be compared to the components of our solar system. Their arrangements and motions are similar. In the tiny, invisible atomic system, the nucleus is the sun and the electrons are the planets. In combination, these particles form all the solids, gases and liquids in the universe.

Scientists know that the nucleus of the atom is itself composed of particles, called neutrons and protons. Electrons sometimes are created and emitted by a "parent" nucleus in a process known as "decay." This explains the change of one element into another — as the "decay" of cobalt into nickel. This is beta decay, or weak interaction—the fourth force.

Until recently, it was believed that all the four forces behaved alike. This assumption involved a fundamental concept of the universe. It was assumed that the universe was symmetrical. That is, it looked the same from both sides; its image in a mirror would be the same as its real self. All nature was supposed to read the same from right or left, like a palindrome—"Madam, I'm Adam," or Napoleon's complaint, "Able was I ere I saw Elba."

Nature was supposed to make no distinction between right and left, plus and minus charges, and past and future. If everything were reversed — plus turned into minus, minus into plus, right spin to left spin, right rotation to left rotation—the face of nature would remain exactly the same. There would be no difference between matter and "antimatter" as the reverse of nature is called.

It had been demonstrated that this parity principle operated on particles involved under gravitational, electrical and nuclear forces. But did parity operate in beta decay, the weak interactions?

This fourth force, as Ringo said, had been troubling physicists for a long time. In weak interactions certain particles had appeared that apparently obeyed none of the usual laws. They were called "strange" particles. Physicists didn't know what to do about them until Yang

and Lee pointed out, quite simply and briefly, that science had not tried to find out if the parity principle was valid for processes involving these "strange" beta particles.

Scientists quickly got to work. At the Bureau of Standards, physicists froze radioactive cobalt to almost absolute zero in order to still its atoms as much as possible. They lined up the cobalt nuclei in a magnetic field, to point all north poles in the same direction and south poles in the other direction. Then they measured the number of particles coming from each end.

If parity held—if nature was symmetrical—the emissions should be evenly distributed between the two ends.

But the scientists found that more particles came from one end of the nuclei than the other. In this one case, it could be said, nature did make a distinction between right and left. Nature would not be the same thing if reversed; its mirror image would be opposite from the real thing.

At Columbia University and in the Enrico Fermi Institute for Nuclear Studies at the University of Chicago, the same results were obtained with the use of the meson, another subatomic particle.

At Argonne, near Chicago, Ringo and his associates, in conjunction with Telegdi, set out to verify these results with the most elementary beta decay of them all, that in which a neutron is transformed into a proton by the emission of an electron. They used neutrons oozing from the sides of an atomic reactor. And they found that only 62 percent as many electrons escaped from one end of the neutrons as from the other.

Parity thus fell from its pedestal.

The Argonne time-experiment involves this principle: Time is measured according to change. If there were no change there would be no time. By changing things back to their previous conditions, you have reversed time.

The colliding billiard balls, Ringo said, would retrace their precise paths. Would the particles in beta decay do the same? Would the past be the same if we went back to it?

"That's the question," Ringo said.

"It shows," exclaimed Telegdi, "that we had accepted a law of nature that never existed. We are now conducting experiments that we would never have done otherwise."

But do we know yet why one of the four forces varies in its behavior?

"We're working on that now," Telegdi said.

THERE ARE NOW in the U.S. at least 20,000 retired engineers and natural and physical scientists, most of whom are able and anxious to contribute to the nation's defense effort, according to G. Warfield Hobbs, chairman of the National Committee on the Aging. If only 1,000 scientists and engineers resumed only part-time work, it would mean that 2,000,000 highly skilled annual man-hours could be added to the national defense effort, Hobbs said.

Car manufacturers have made engines more powerful, styling more dramatic, and riding more comfortable . . .

But What Have They Done About Safety?

by William Carroll

Condensed from Motor Trend

WITHOUT a backward glance, the man stooped to slash a seat belt with his knife. Twice he had to cut before the web strap separated from its floor anchor. Within 15 minutes the knife-wielder cut belts from every car in the dealer's showroom.

The time: eight years ago, when Nash hopefully installed seat belts in their 1950 models. But John Q. Public took one look and said, "Do I have to use a seat belt to ride in this automobile?" The negative reaction hurt Nash sales, and dealers began cutting safety out of new cars before the factory eliminated the belts as standard equipment.

By 1955 every motor car maker had men trying to find answers to problems of car safety. Dealers were displaying padded instrument panels and optional seat belts, when in mid-1955 some General Motors production lines began quietly installing new safety latches that reduced chances of doors opening in an accident.

Ford teed off its 1956 models with a "Lifeguard" safety program of padded dash, seat belts, safety steering wheel and advertising. Results were something less than happy. Of the 1956 models, 500,000 had padded dashes. Approximately 100,000 were equipped with seat belts. And Ford lost $800,000 on installation of the safety devices. Other makers

quietly followed Ford. Dished steering wheels and safety door latches could be found on almost every make, with dash padding, and seat belts as extra-cost option on many.

July of the same year found a congressional investigation beating the safety bushes around Detroit. The Special Subcommittee on Traffic Safety of the Committee on Interstate and Foreign Commerce set out, as part of their aim, ". . . to determine the extent to which excessive speed, intoxication, lack of adequate safety inspection of vehicles, insufficiently strict state and local laws, poor condition of highways and other factors have been responsible for such increase and for resulting deaths. . . ."

PERUSAL of the committee's 927-page hearings transcript shows that about half their time was spent in Detroit watching crash tests and listening to auto "brass" thump the tub for each corporation's safety research.

Meetings held for the safety committee included one where American Motors president, George Romney, made a good pitch for unitized body construction (in Rambler and now in '58 Lincoln) by saying, "When we started with unit body-frames we had about 6,000 foot-pounds per degree of deflection (unsupported frame corners are weighed to determine how much force is required to bend them 1 degree), as opposed to competitive cars that ran from a low of 2,000 foot-pounds up to as high as 4,000.

"In our latest (1956) cars we are up as high as 7,000 foot-pounds torsional resistance per degree of deflection. With conventional construction the lowest is now about 4,000, the highest around 5,000 foot-pounds."

At Chrysler's proving grounds in Ypsilanti, Mich., the committee was shown charts covering such esoteric subjects as roll angle, suspension frequencies, steering geometry, etc. Revealing was a discussion of problems in designing a safety door-latch. Test engineers ruined many a sedan to find out what kind of a wreck caused doors to pop open. Finally in roll-over tests at 45 miles per hour, they succeeded in opening one or more doors every time.

MEANWHILE the designers offered several new latches. One was accepted for roll-over testing. But at the proving grounds, doors still opened, though laboratory tests had convinced the engineers that they couldn't.

There was a lot of soul-searching and inspection of slow-motion movies before the villain was found: the outside door handles had been snagging themselves open as the car rolled. Engineers began locking their new doors on the inside and since then they have not been able to pop a single locked door equipped with the safety latch.

Ford went all out to demonstrate methods of test-crashing cars, evaluating dished safety steering wheels and test instrument panel safety pads designed to absorb the collision impact of nearly-human dummies. A

chart ("Passenger Car Horsepower vs. Traffic Fatality Rate") thoroughly stoned soapboxers who shouted of dangerous high horsepower. The chart showed that since 1935, fatalities per 100 million miles of driving have dropped from 8 to 4.5 (National Safety Council says 8 to 6.4). During this period, horsepower rose from an average of slightly over 100 per car to nearly 180.

General Motors put on demonstrations which utilized findings of their research into the often suggested "Shock Absorbing Bumper." They slide-ruled that to stop a car at a rate similar to maximum brake use on dry pavement, the shock absorbing bumper would have to be 11 inches from the front of a car traveling only 5 mph. The bumper would have to be extended 177 inches — or almost a car length in front of the body!—to safely stop a car from a speed of 20 mph.

GM also displayed a sedan with rearward facing seats. Seat-backs on the driver's right interfered with his vision and rear seat passengers had no room for their feet because of a hump for the rear axle.

Time ran short before the safety committee could visit Studebaker-Packard, so safety engineer Donald Schrum came to the committee. He pointed out that S-P offered what everyone else had (safety door latches, padded panels, seat belts, etc.) plus touches of their own. Mentioned were the nearly eye-level speedometers minimizing the time a driver's eyes must leave the road, and fade-resisting finned brake drums on more powerful V8s.

• Every man has a right to his own opinion, but no man has a right to be wrong in his facts.

—Bernard M. Baruch

WHILE auto makers and congressmen were dancing around the Maypole of traffic safety, the work done in 1955 by design engineers began appearing on the market.

A year and a half later the United Press issued a report on auto safety based on studies by the Cornell University Project. The UP stated, "Drivers and passengers were as likely to get injured or killed in cars of the 1950-'54 vintage (10.5 percent hardtops) as in older vehicles dating from 1940-'49 (only 2 percent hardtops), though in some cases the newer cars resulted in more frequent and severe injuries. But this was not due to such factors as 'thinner corner posts and collapsing roofs,' but rather to other reasons such as interior design and the tendency of unsupported hardtop doors to pop open."

"The plain fact is," said one Cornell researcher quoted in the UP report, "there is little difference between a 1954 car and a 1940 car as to the injuries that can be sustained in each. Now that manufacturers have begun to adopt such devices as belts, padded panels, safety door locks, etc., it is possible to say that you stand less chance of getting hurt in a 1956 or 1957 car than in earlier models."

In dealers' showrooms, it's a dif-

ferent story. Loaded cars usually have factory safety kits (dash and visors) as part of the deal. Buy the car, you'll get safety too. But practically no car in the showroom of a metropolitan dealer is equipped with safety belts. If you order them, you'll have to wait until a set is found to match the upholstery. And you get a firm price first. A Plymouth purchaser paid over $50 for two standard belts, and the dealer swore the charge was legitimate.

On the '58s safety is well advertised. Each maker points to lower centers of gravity, better handling, better brakes, better visibility, and brighter colors.

New X-type GM frames were crash tested for resistance to side impact. Design improvements resulting from the tests were thicker body rocker panels and more rigid sheet metal for body members.

Ford's lower price cars use a "cowbelly"-type frame which acts as a sturdy steel bumper along both sides of the car.

Lincoln has turned to a unitized body—long used by American Motors—which seems to have great resistance to collision damage. Studebaker-Packard uses welded box-type doors for resistance to side impact.

But men behind the pencil are frankly stumped. Where do we go from here? How much safety can be built into a production car? Would the public (you, that is) pay $300 more for a safety car on the chance of being in that one fatal collision every 16 million miles? "Will safety sell?" That is the really hard nut Detroit has to crack.

The speed that most of us drive on cross-country trips has risen only slightly. Cornell reports that average car speeds on the highway are about 30 mph in urban districts, a nominal 50 mph in rural areas. When it comes to relating speed and accidents, figures on the speedometer change. The report shows that impact speed of cars (the speed at which they become an accident statistic) averaged only 42 mph in the country and 27 mph in urban areas.

What this adds up to is stated simply by the *Wall Street Journal:* "What is curiously overlooked in the talk of safety is the simple fact that the more cars there are on the roads, the more accidents there are bound to be, just as a population increase means an increase in crime. This may be unfortunate, but it is pretty difficult to imagine any feasible way of restricting the volume of traffic. In any case, the notion that drivers are getting more reckless is a statistical illusion."

If accidents are going to be with us for some time, you might wonder what the odds are against one. In 1956 the figures worked out to a collision every 61,000 miles, an injury every 430,000 miles and one fatality every 16 million miles.

Has there been a reduction in the death rate? The National Safety Council's answer is a definite "Yes." Their charts show the traffic fatality rate has already fallen from 15.1 fatalities per 100 million miles in 1936 to 6.4 fatalities per 100 million

miles as of 1955. And the reduction in fatalities per mile was during a period when the number of motor vehicles in use *more than doubled.*

So — now what? Cars are safer. Roads are no worse and are getting better. Speeds have not jumped out of hand, nor has speed been proven the prime cause of accidents.

That leaves safety up to you.

Do you keep your full attention on road conditions ahead? (In 19 percent of urban and 16 percent of rural accidents the car hit an immovable object!)

Do you figure that slowing down when the highway twists and turns is less expensive than injuries from a roll-over? (Twenty-six percent of rural accidents — and 1 percent of urban — occur when the car rolls over, without any collision.)

Does the other driver always know what you're going to do next? (Simple car-to-car collisions make up 49 percent of urban and 35 percent of rural accidents.)

Did you know that windshields are damaged by the occupant's head in 25 percent of the collisions? Instrument panels are damaged by the occupant's head or body in 16 percent of urban and 24 percent of rural accidents? (Reports already prove that safety belts will reduce damage to both you *and* the car.)

Hospital records show that major causes of serious injury are the steering assembly (29.4 percent), instrument panel (20.6 percent), windshield (16.9 percent), and ejection through an opened door (14.6 percent). If you spend about $35 for seat belts—correctly anchored—and a padded dash in a new car with dished steering wheel and safety door locks, you can greatly reduce your chances of being hurt by more than 80 percent of the major causes of collision injury.

"What have I done for safety?" may be the real question to ask the owner of your car. For as any doctor will tell you, it's people—not cars—that get killed in an accident.

French Trains Run Without an Engineer

FRENCH RAILROADS are ready to put locomotives without engineers into service, reports the *Chicago Tribune.*

They have tested remote-control trains on a 35-mile stretch of track between Dole and Vallorbe in eastern France on the Paris-Lausanne-Milan main line. The experiments have convinced technicians that locomotives without drivers are safe.

Technically speaking, the idea of trains without drivers is not fantastic since signalling is automatic on hundreds of miles of track. The power and direction of trains can be centrally controlled, so that the only job of the engineer at present is to run his train at maximum speed.

Besides operating trains without engineers, French railroaders are concentrating on electrifying lines and increasing speed.

BOOKS

IN SEARCH OF MAN, by André Missenard (Hawthorn Books, Inc., $5.95). An inquiry into the forces which mold man (i.e., chemical, physical and psychical environments) and some recommendations as to how these forces may themselves be shaped to insure man's best development. By a prominent French engineer and teacher.

ONLY A TRILLION, by Isaac Asimov (Abelard-Schuman, $3.50). Prof. Asimov, who is equally at home in science and science fiction, explores a miscellany of science wonders, from the high jinks of radioactive substances to the chemical bases of life.

BOOK OF THE SEVEN SEAS, by Peter Freuchen (Julian Messner, Inc., $7.50). The late explorer tells a story of the sea that rambles through sea dragons and giant navies, fact and fiction, myths and strange tales.

LONG, LONG AGO, by Mary Lou Clark (Pageant Press, Inc., $2). For younger readers, Mrs. Clark traces the rise and fall of the dinosaurs and other giant reptiles who ruled the earth 150 million years ago.

THE NEW LANDSCAPE, by Gyorgy Kepes (Paul Theobald and Co., $15.50). Artists and scientists seek to understand and visualize our increasing knowledge of the natural world. Profusely illustrated, this book presents the views gained, with pictures and commentaries by leaders in both fields.

FROM A CHINESE CITY, by Gontran de Poncins (Doubleday & Co., Inc., $5). An account of the ancient Chinese culture, before the impact of Communist rule, by a Frenchman who remembers it with understanding.

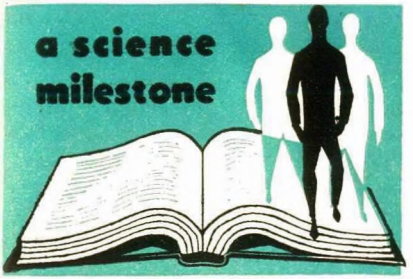
The books listed above are not available from SCIENCE DIGEST but may be obtained from the publishers named and, in most cases, from bookstores.

Find Vitamin A Helpful in Treating Corns

INJECTIONS of vitamin A under painful corns have stopped the pain after all other forms of conventional treatment failed, according to Dr. Bernard Drummer, a Bronx, N. Y., podiatrist.

In a trial series of 21 patients with painful corns, the vitamin-A preparation was injected around the corn and eliminated all symptoms of the condition. Before the injections, many of the foot sufferers had needed regular attention at short intervals in spite of silver nitrate applications, anesthetic injections of procaine and the like, Dr. Drummer said.

Corns are caused by an irritation that stimulates the growth of the skin in the outer, or horny layer. The vitamin-A injections cut down this growth and cause the corn to shrink in size and sometimes disappear altogether. Even if the corn is not completely eliminated, the pain stops almost immediately, Dr. Drummer said.



GEORGE STEPHENSON

Father of Railroading

by Elliott H. McCleary

UNTIL HE WAS 18, the great engineer who founded modern railroading could neither read nor write. The son of a poor Scotsman who as a youth emigrated to the coal fields of Northern England, George Stephenson was born on June 9, 1781, in Wylam, England. There was no school in the town for mine workers' children, who went to work at an early age to supplement the family income.

George's father Robert supported his wife and six children with the meager wages he earned as fireman of a primitive steam pump which kept a Wylam coal mine free of water.

Past the Stephenson cottage at Dewley Burn where the family later moved ran a wooden railway upon which horses drew wagons of coal from the mines to the riverport of Newcastle.

A few years later, George Stephenson was to combine these two elements of his boyhood surroundings —steam and rails—into a development which would revolutionize the 19th-century world.

• • •

The steam locomotive and the railroad upon which it ran were fathered by many men. As early as 1630, wooden railways consisting of pieces of planking laid parallel upon wooden supports were being used in the coalfields of northern England to permit horses to draw heavy loads of coal. Much later, wooden rails were formed with a rounded upper surface to fit concave-surfaced wagon wheels.

In 1776, one of the first cast-iron railways, built with a flange on the edge of the rail to guide the wheels, was laid down near Sheffield by a John Curr, who had to flee for his life as rioting colliery workers opposed to technological progress tore up his new tracks.

Thomas Savery had patented a rude steam engine in 1698. Thomas Newcomen, a few years later, improved upon Savery's engine enough so that his model could be used to pump water from the coal mines.

In 1769, the same year that James Watt patented his improved steam engine, a Frenchman named Nicholas Cugnot built a two-cylinder, three-wheeled steam carriage. But

during its first official trial it knocked down a stone wall that stood in its way and couldn't attain a road speed faster than a slow walk.

A later, slightly faster model that was tried in the streets of Paris became overbalanced while turning a corner, fell over with a crash, and was locked up as a menace to public safety.

Englishman Richard Trevithick is generally credited with building the first successful railway locomotive, in 1804. A well-finished though odd-appearing machine with a horizontal, cylindrical wrought-iron boiler which enclosed the furnace, it had a single piston at the front which operated a gigantic fly wheel that transmitted its power to the four running wheels by a system of cogged wheels.

On its first trial the engine drew for a distance of nine miles ten tons of bar iron, together with the necessary carriages, water, and fuel, at the rate of 5½ miles per hour.

But when the machine was put to work it proved too heavy for the plate rails of weak cast iron. On its journey to the railroad upon which it was intended to work, it broke a great many tram plates, ran off the road, and was brought back by horses, being used thereafter as a stationary source of power.

Inventor Trevithick lost interest in locomotives after that, turning his attention to stationary engines, tunnel building, steamships and silver mining in the Peruvian Andes. His hopes of building an immense fortune in the New World were blasted by revolution, and in 1827 he managed to escape from his rebel keepers and fled penniless to England, where he died in 1833.

GEORGE STEPHENSON began his working life as a cowherd at the age of eight. Better wages attracted him to the colliery, where he joined other children in the monotonous task of picking stone and slate from the newly mined coal. Soon he graduated to driving a horse which trod an endless circle as it supplied the power to draw buckets of coal from the mine.

At 14, he became assistant stoker of his father's pumping-engine furnace at Dewly Burn mine. Fascinated by machinery, he soon learned how to take the pumping engine apart and put it back together again, lovingly cleaning it and making minor improvements as he did so.

By the time George was 17, he was admitted to be the best illiterate mechanic at the mine. But without an ability to read and write, he could rise no further. So he started to night school. By this time, he had been placed in charge of an engine which he maintained so well that it never broke down, and he had time to learn his letters and chalk up sums on the walls during the day.

Before he was 21, he had advanced far enough so that he could read scientific books with difficulty; he had accumulated a large collection of tools with which he built an unsuccessful perpetual-motion machine. He became the operator of a stationary engine which powered the removal of ballast from coal ships.

1781—George Stephenson—1848

At the age of 21, he married 33-year-old Fanny Henderson; the marriage proved happy for a time. A son, Robert, was born the next year. But their second child, a girl, died in infancy and soon thereafter Fanny died. He was to remain a widower until he was 39, when he took Elizabeth Hindmarsh as his second wife.

Upon his wife's death, he placed his two-year-old son in the care of a kindly neighbor woman and went to work for a year as an engineman in a Scottish knitting mill. He returned upon hearing that his father had been burned and blinded for life while cleaning inside a boiler that was accidentally closed and fired up.

New troubles arose; George was conscripted to fight in England's war against Napoleon. He used most of his savings to hire a soldier to serve in his stead. He paid off his father's debts, became the sole supporter of his parents, his sickly young son and his sister Eleanor, who now cared for the boy. He went to work at the mine, tending his old steam engine, and made extra money on the side by fixing clocks and watches.

SOON, HOWEVER, arose his first great opportunity. A nearby mine that had been flooded for a year was the despair of its engineers and owners. George Stephenson promised to fix the pumping engine so that it would enable the mine to be cleared in a week. This he did, and was awarded by being made permanent engine wright and, later, head engineer of Killingworth Collieries at the princely salary of 100 pounds a year.

Here he began to work on his first locomotive. Since Richard Trevithick's engine of 1804, others had built crude "traveling engines." Some of these traveled not on rails, but on the public roads; none proved very practicable.

The owner of a nearby colliery, a Mr. Blackett, had built "Black

Billy," which had a cogged driving wheel on one side, the cogs fitting into the rackrail beside the track. Daily it traveled from Wylam to Lemington, dragging a train of eight or nine loaded coal wagons, accompanied by much puffing, jerking, and spewing of red-hot cinders.

In 1813 Blackett and a William Hedley built an improved locomotive which traveled on smooth rails without the rack mechanism. This engine and "Black Billy" operated for years, despite a crawling speed of 2-1/2 miles per hour and a tendency to break or sink through the 3-foot-long iron-plated wooden rails.

Stephenson studied the imperfect Blackett engines, convinced his employer he could do better, and in 1814 directed the building of "Blucher" in a local blacksmith shop. This was a two-cylinder engine that did the work of 50 horses, pulling 30 tons of coal uphill at 4 miles per hour. The machine, driven by George's eldest brother James, was used for years thereafter.

In this engine, for the first time, the waste steam exhausted from the cylinders was directed up the smokestack to make a draft that greatly increased combustion. The next year George Stephenson built "Puffing Billy," and further improved the smokestack draft.

More traveling engines were built by Stephenson, and each was an improvement on the last. He also developed improved rails on which to run his locomotives. One of his patents "lapped" the ends of the rails to create a smoother running surface.

Stephenson's reputation grew with each new locomotive. In 1818 the owners of near-by Hetton Colliery borrowed him from his regular employer so that he could design an eight-mile-long colliery railway for them. The finished railroad and its locomotives were necessarily crude, but the owners were well pleased. Soon Stephenson would build the world's first public railway.

BUT GEORGE STEPHENSON is remembered for another great achievement apart from railways; the invention in 1815 of the "Geordy Miners' Safety Lamp," which he successfully tested 19 days before Sir Humphrey Davy announced the development of his safety lamp.

Unknown to each other, the two men at the same time developed similar lanterns based on similar principles to combat the dangers of "fire damp," a combustible gas, which constantly seeped into the mines. Because of it, miners were forced to work in almost total darkness. When they lit a candle, a disastrous explosion often resulted.

Davy's idea was to dissipate the heat of the flame with metal gauze around it. Stephenson's lamp housed the flame in a glass chimney which created an updraft. At the top of the chimney was a perforated metal cap which cooled the flame's heat below ignition temperature.

Stephenson, however, had designed the metal cap to prevent unburnt particles of combustion from passing through and igniting the gas outside. Unwittingly he had used an incorrect

theory to produce a successful effect.

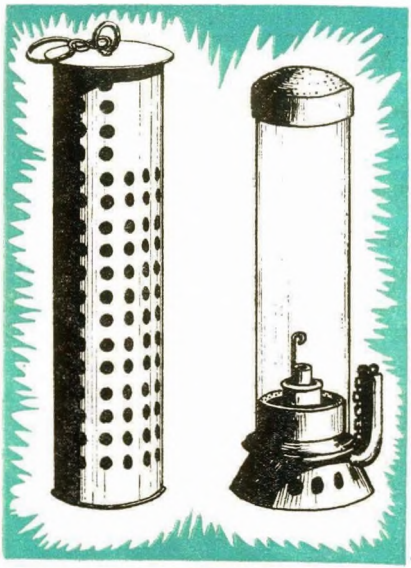
His lamp was used for scores of years thereafter in the northern English mines, and some of its principles were used in the improved Davy lamps which followed. Both the early Stephenson and Davy lamps warned users of the presence of fire damp by flaring up and then going out.

IN 1821, George Stephenson's fame as a railway engineer had traveled 50 miles south to the towns of Stockton and Darlington, soon to be linked by the world's first public railway. Edward Pease, a wealthy Quaker woolen merchant, was the chief backer of the enterprise, and it was he who engaged Stephenson as head engineer to survey the land and build the railroad.

The road, 25 miles in length with all of its branches, was to carry coal and other freight, and horse-drawn passenger coaches would also be permitted. Most of the backers had no idea that anything but horses would draw the cars, although there were plans to use stationary engines on some of the branches to pull the cars by cable up inclined planes.

Pease and Stephenson, however, had other ideas. At first secretly, then openly, they pooled financial resources and established a locomotive shop to build three locomotives for the new railway.

On September 27, 1825, after three years of toil by hundreds of workmen under Stephenson's direction, the railroad was finished. Thousands of excited spectators lined the right of way as the shiny new "Locomotion" pulled a train of 36 cars packed with 700 passengers. Before the day was over, the sturdy engine had attained an unprecedented speed of 14 miles per hour, and the Stockton and Darlington Railway began an immediately popular and profitable operation.



STEPHENSON'S SAFETY-LAMP, at right. The lamp's cover is shown at the left.

Before the Stockton and Darlington was completed, Stephenson had embarked on other railroading ventures. The first was the eight-mile Canterbury and Witstable Railway, completed after five years and featuring both stationary cable engines and a locomotive built by the Stephenson works. Next was the Liverpool and Manchester Railway, begun in 1824 but not finished until 1830.

This project had a stormy begin-

ning. Tales that the new railroad would despoil the countryside circulated among the landowners, who incited their tenants to harass the surveying crews with sticks and stones and pitchforks. Surveying instruments were smashed by enraged mobs. Often Stephenson's surveying crews were forced to work by moonlight, and woeful mistakes resulted.

The undertaking was a huge one. At one place, progress was delayed for many months as Stephenson's men piled hundreds of tons of brush into the 30-foot-deep muck of a 3-1/2-mile-wide bog the railroad was to cross—and did. Hills were cut through and tunnels were dug, including one 1-1/4-miles long under Liverpool; at least 63 bridges were built.

Stephenson was the chief engineer of the project; but few people, even his friends, thought that Stephenson locomotives should be purchased for the new line. A competition was finally agreed upon. Stephenson and several others began to build locomotives designed to meet requirements set forth by the railroad's backers. The winner would receive the franchise to supply locomotives for the railroad.

Stephenson's entry was the famous "Rocket," built with the help of his son Robert, now an accomplished engineer. Its basic features have been embodied in successful steam locomotives to this day. They included: an improved steam blast for urging the combustion of coal; a boiler (suggested by Henry Booth) in which a large heating surface was gained by means of many small tubes through which the hot gases from the fire passed; cylinders which were set at a slope, rather than being vertical as in earlier locomotives (later this position was altered to an almost horizontal angle); subsequently was added the "link motion"—instead of chains or cogs—which permitted the engine to be reversed easily.

Competing with three other locomotives, all of which developed technical difficulties and proved unsound, the "Rocket" won the trials. Its success was assured when it drew a coach containing 30 passengers at a speed of 29 miles per hour.

With the contract and the 500-pound prize in his pocket, and in his ears the cheers of observers who had come from all over England and Europe to watch the trials, George Stephenson's standing as the world's foremost railroad engineer was sure.

THE Stephenson locomotive works continued to build better locomotives each year, with improvements such as the self-acting brake and springs to ease the lot of the cinder-strewn railroad train passengers.

Stephenson and his son were soon busy surveying, planning, improving and laying railways all over England, in addition to operating England's greatest locomotive factory, as a network of railways began to spread over the civilized world. George Stephenson directly superintended the building of some railways; for others, he acted as the consulting engineer. Sometimes Robert directed the building.

Between 1828 and 1901, the Stephenson locomotive works shipped 145 "first" locomotives to practically every country in the world, including Ceylon, India, Australia, Argentina, and the Union of South Africa. Among those sent to the United States were the "John Bull" and the "Davy Crockett." The "Stourbridge Lion," built by an English firm to Stephenson's specifications, was tested at Honesdale, Pa., on August 8, 1829.

Stephenson became a wealthy man, and extended his holdings to a coal mine and a limeworks. He was consulted by the leading railway engineers of the world and by struggling young inventors. He laid out the railway system of Belgium, and was a guest of its King. He watched his son Robert become famous as "England's Bridge Builder."

Attempting to retire at Tapton House, a country estate in Chesterfield, he soon found himself in the midst of experimentation in horticulture and agriculture. Then, weakened by an arduous surveying trip through Spain three years before, he died on August 12, 1848.

Elaborate eulogies were written and delivered upon the occasion of his death. But perhaps the most apt tribute he has ever received was given the day the "Rocket" steamed down the shiny tracks of the just-opened Liverpool and Manchester Railway. The Duke of Wellington spoke it:

"By your genius, you have taken the imperfect inventions of your predecessors, and fusing them with the products of your own genius, have created the steam locomotive and the steam railway."

No Proof Yet That Smoking Causes Cancer

"DESPITE all the attention given to smoking as an accused factor in human lung cancer, no one has established that cigarette smoke, or any one of its known constituents, is cancer-causing in man."

This was reported by Dr. Clarence Cook Little, scientific director of the Tobacco Industry Research Committee.

Other points made by Dr. Little concerning the smoking-lung cancer problem included:

1. Animals exposed to massive doses of cigarette smoke have not developed lung cancer as a result.

2. Tobacco smoke condensates, painted on susceptible animals in the same quantity and exposure times that human smokers receive them, have failed to cause any skin cancer.

3. Nicotine does not constrict the outlying blood vessels of all people, as has long been thought. It may even result in a dilation of larger vessels, like the coronary arteries.

4. Cigarette smoking by patients with duodenal ulcers did not create significant changes in certain gastric secretions usually associated with ulcers.

LETTERS

Classroom Heroes

Sirs:

As students we have observed that those who are scholastically exceptional receive little gratitude. The hero should be the thinker and not the captain of the football team. The emphasis should be put, rather, upon acquiring knowledge and skills necessary to our national future. If America is to maintain her position in the world, then a change must come about.

LORREN LARWOOD,
ROBERT CLAXTON,
ELMIRA, N. Y.

Bugs and Bacteria

Sirs:

I think it is inexcusable that you should have used the word "bugs" in (describing) the protozoa, bacteria, etc. in the article "Bugs That Feed Bossy" (about rumen microorganisms) in your December ('57) issue.

CAROLE BENNETT,
EASTON, ILL.

The article made clear that the "slang" term "bugs" referred to bacteria and protozoa. One of the definitions (slang) of "bug" in Webster's New International Dictionary *is "a microorganism, especially a disease producing germ."* —EDITOR

Too Slow?

Sirs:

In your January ('58) issue you say, "an electronic computer that can add or subtract 30,000 numbers a minute has been used successfully to interpret four foreign languages . . . into . . . English." You should have said 30,000 operations per second, because a computer with such a primitively slow speed of only 500 operations per second would not be able to ". . . type out a whole page of English translation . . . in several minutes."

C. GARY PHIFER, JR.,
ATLANTA, GA.

Francium

Sirs:

I have been unable to find any information about the element Francium. Can you help me?

STUART KELLEY
HILLSDALE, N. J.

Francium is element No. 87 and information on it may be obtained from any fairly recent encyclopedia. Older encyclopedias may have this element listed under the name "Virginium," so named by two American scientists who claimed to have discovered the element in 1930. Their discovery is no longer generally accepted by scientists. Mlle M. Percy of France reported discovery of Francium in 1939. —EDITOR

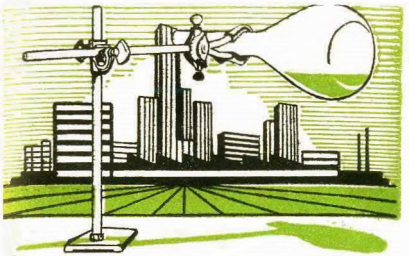
Light and Sex

Sirs:

In your November ('57) issue, p. 61, it is stated that "in order to get more female fish, guppies are bombarded with rays generated by ordinary fluorescent lamps designed to emit a deep pinkish glow," while in another paragraph (same item), talking about flowers, it is stated that "pinkish rays made the same plants bring forth only male blooms." Please, which is which?

EDERICO HEILBRONN,
TEXCOCO, MEX.

We see no reason why the wording should lead to confusion. There is a world of difference between fish and plants, and it's almost to be expected that the same light would produce different results. —EDITOR



INVENTIONS PATENTS PROCESSES

"Hi-Fi" Ears Hear Car Creaks

The automobile companies are using electronic detectives to track down and eliminate vibration and noise in their autos.

As reported in *The New York Times*, engineers of the Fisher Body Division are using the electronic hearing capacity of highly sensitive microphones and magnetic stereophonic tape recorders in developing car bodies for General Motors. In this way, they say, they can locate noise "gremlins" that otherwise might harass a driver.

In the effort at General Motors to eliminate vibration noises, hundreds of torsion, bending, shake and breakdown tests as well as static tests are made, first on experimental bodies. Once production begins, the completed automobiles are taken to proving grounds for sound-testing with the delicate detecting and recording instruments under operational conditions.

In evaluating insulation and sound-deadening materials, two microphones are set up in positions corresponding to the human ears. Through these microphones engine noises are recorded simultaneously on a high-fidelity tape recorder utilizing two separate channels.

Noises from a car actually in motion are recorded by equipping it with microphones that are connected by a cable to a station wagon carrying the recording instruments. The car being tested travels on a rough road bed while the station wagon follows on a smooth road adjacent to the rough one.

Getting the frequencies and the intensities of the noises on a sterephonic tape is only part of the job. The playback for evaluation of insulation and sound-deadening materials is heard by highly qualified sound engineers whose hearing senses have become extremely keen through years of experience.

The body noises recorded with various types of sound-deadening material are played back for a 10-second period for each. The sound-engineer jurors hear the recordings at the same time and indicate by pressing pushbuttons on the table in front of them which sound deadener they consider most effective. A tabulating instrument shows the results and thereby renders the verdict.

Develop Synthetic Chocolate

A New York chemist recently won a patent for developing a synthetic chocolate. According to the inventor, Dr. Simon L. Ruskin, the synthetic chocolate simulates the smell, flavor, color, and nutritional values of the real thing.

Doctor Ruskin says the new chocolate can be eaten by people who have cocoa-bean allergies. By adding substances that prevent air- and seasickness and curb fatigue, manufacturers could make chocolate useful for aviators and other travelers. The inventor also states that the chocolate has bacteriostatic properties so that it will keep milk sweet for as long as 6 weeks when mixed with it.

The synthetic chocolate is made from

sugar, protein, and a chemical compound derived from oat hulls. Dr. Ruskin says it is also possible to produce synthetic coffee and maple sirup by the same process.

The patents for the synthetic chocolate are held by the Union Carbide Corp.

Device Helps Deaf Hear Through Fingers

A new device that allows deaf people to "hear" through their fingertips has been reported at a meeting of the American Association for the Advancement of Science.

The basic system uses a small device so constructed that the "listener" rests his 5 fingers on separate receiving diaphragms. These are connected by wire to the "speaker's" apparatus which resembles a tiny organ.

Depending on how the speaker operates the keys on the organ's keyboard, one or another of the listener's finger diaphragms will vibrate.

It has been possible to send 31 symbols of information by employing a coding which uses a single frequency transmitted singly or in combinations by the 5 fingers.

A prototype model that uses 2 frequencies and their possible combinations is being used for research in reinforcing learning of lip reading (66 percent of spoken sounds have low visibility ratings), speech learning and improvement, and acquiring language concepts. The model was made by The Ramo-Wooldridge Corp.

Cigarette-Sized Lamps Floodlight 16-Mile Area

Twelve tiny lamps, each smaller than a king-size cigarette, which together emit a light source equivalent to 36 million candlepower, are part of the amazing equipment used in night aerial photography experiments by the Naval Air Development and Material Center near Hatboro, Pa., reports *The Philadelphia Inquirer*.

Housed in special reflectors and mounted in the bottom of an airplane flying at an altitude of 20,000 feet, the miniature lights can produce sufficient illumination at night to cover an area of 16 square miles and bright enough so a newspaper can be read easily.

The tiny quartz tube is filled with mercury. It is less than 4 inches long, and in diameter it is thinner than the average cigarette. It throws off a purplish-green light, similar to that used in the processing of blueprints, say the developers of the unique light source.

Mass-Produced Solar Furnaces

Sun-powered furnaces are available now on a mass-production basis. The solar furnaces, mounted on surplus military searchlights, make it possible for more colleges and laboratories to conduct high-temperature research on strategic materials.

Gerard J. Wendelken, vice-president of the American Searchlight Corp., which produces the furnace, said the equipment can be afforded by low-budget colleges and research institutions because of a design based on surplus searchlights.

Wendelken said the mass-produced solar furnace sells for $8,500. "The searchlights, of little use in this age of high-speed aircraft, originally cost the government around $25,000 each." A similar furnace built from new materials would cost a buyer $40,000 to $50,000.

Solar furnaces use one or more mirrors to bring the sun's rays to a high-temperature focus. The mass-produced model reaches temperatures up to 8,000° F.

Sun-powered furnaces are used in research on ultrapure metals and other jet and rocket materials because they do not contaminate the materials under study.

When strategic materials are melted in even the hardest containers, small amounts of the container enter the molten material as impurities. The same materials can be suspended at the focal point of a solar furnace and melted without touching a hot container wall.

Portable Iron Lung

A lightweight iron lung that can be transported in a station wagon promises faster relief for polio victims. The mechanical lung was invented by William H. Haverland of Morrison, Colo., who claims that it is designed to be easily transported, stretcher-like with its power supply, by a 4-man team.

Another aspect of the portable lung is that it can be opened its full width and length to make it easier for the doctors and nurses to place a patient in it, or remove a patient from the iron lung.

The iron lung is 22 inches high, 27-1/2 inches wide, and about 84 inches long. Without its patient, it weighs 120 pounds. The lung is powered by a portable respirator. The patent rights were assigned to the J. J. Monaghan Co., Inc., of Denver, Colo.

Plastic Film Reproduces Drawings for Blind

A practical method has been developed to produce drawings which can be read easily by the blind. An effective drawing kit is now available which produces raised lines on thin plastic film by the use of an inkless ballpoint pen and a specially designed writing board.

To use this kit, a sheet of plastic film is clamped to a rubber-surfaced writing pad. Firm writing pressure with an inkless pen results in a series of tiny bumps, which appear as raised lines on the upper surface of the film, easily traced with the fingertips.

In addition, the drawings can be permanently and safely stored since the film used does not become brittle or deteriorate with age.

Thousands of these drawing sets are now being used by the blind. Uses include solution of geometry problems, drawing of graphs and electrical circuit diagrams, and preparation of maps.

Until the development of this system, a tracing wheel such as seamstresses employ was standard procedure. This was inconvenient since it resulted in a reverse drawing.

The plastic film used in the kit is manufactured by the Du Pont Co.

Giant Vacuum Chamber To Test Airplanes

Altitudes up to 100,000 feet and aerodynamic heat up to 830° F., will be simulated in a new test chamber completed for the F-106A "Delta Dart" at Convair (San Diego) Division of General Dynamics Corp.

First of its type in the aviation industry, the vacuum test chamber is a steel cylinder 12 feet in diameter and 70 feet long. It will enclose a full-scale fuselage to test how effectively the electronic and air-conditioning components in the F-106A all-weather jet interceptor perform under extremes of altitude and temperature.

Heat from two sources affects performance of the electronic guidance and fire-control equipment in the F-106A: (1) That generated by the equipment itself; and (2) that which soaks into the electronic systems from air friction on the outside surface of the aircraft. Accordingly, the electronic equipment must be air-conditioned so the elec-

tronic components will still function properly.

Built of 3/8th-inch steel, the test chamber is divided into two 35-foot sections. When the chamber halves are closed, a hydraulic mechanism seals the chamber and engages electrical connections through bus bars mounted at the top of the test stand.

To simulate the aerodynamic heating that occurs on the aircraft's surface at high speeds, the interior walls of the test chamber are lined with reflector panels on which 750 infrared tubular quartz lamps are mounted. Filament temperature of these 2,500-watt lamps reaches 4000° F. — the same as that which can be measured in the heart of the afterburner blast of a J-57 turbojet engine.

When fully energized, the electrical system of the test stand consumes enough power to supply the needs of a town of 2,000 population—about 2,000 kilowatts.

Remote control of the entire test system is accomplished through a graphic panel in a nearby control room. Test engineers can simulate altitudes up to 100,000 feet; moreover, altitudes can be changed while a test is under way to simulate dive or climb maneuvers.

Fastest Camera Shutter

Development of a camera shutter, capable of taking photographs with an effective exposure time of 5 billionths of 1 second has recently been announced by Dr. A. M. Zarem, president of Electro-Optical Systems, Inc.

The company said the camera would prove highly valuable in helping solve scientific problems in the study of intense explosions, of ultrahigh-speed shockwaves and of special nuclear reactions.

The novel feature of this ultrahigh-speed camera is that it contains a hermetically sealed, large aperture, wide-angle shutter which possesses no moving parts and is pulsed electronically to obtain photographs of very brief exposure times. With further refinements, Dr. Zarem said, the camera ultimately may be capable of taking pictures with an exposure time of only a fraction of a billionth of a second.

• • •

To illustrate the speed of the camera, it was pointed out that the satellite Sputnik, moving at a speed of approximately 18,000 mph, would travel only 1-1/2 thousandths of an inch—a distance shorter than the thickness of a human hair—during the time of one exposure.

System Stops Explosions Before They Start

A safety system that outguesses fire, anticipates explosion and automatically takes steps to combat both has been developed. It promises protection for passenger car, military vehicle or airplane fuel tanks.

The system operates on the principle that under normal conditions the chance of fire and explosion in a fuel tank is virtually zero unless a foreign object ruptures or punctures the tank.

The new system has means for sensing the arrival at a fuel tank of such an object. When this happens a combustion-inhibiting substance that will cover the fuel and tank is automatically released simultaneously with the rupture.

One of the ways in which the system does this is to have an electrical sensing circuit so arranged that in order to break the fuel tank, a bullet or object must first trip the safety system into action. As soon as this happens, cap-

sules containing fire-fighting materials are electrically fired in and around the tank.

Patent rights were assigned to Chance Vought Aircraft, Inc., of Dallas, Tex.

Movies with Odors

Scentovision, a blend of motion pictures and appropriate odors, has just been patented, reports Stacy Jones in *The New York Times*. The device picks up signals from the unrolling film, releasing the perfume of orange blossoms to accompany an orange-grove scene and that of sliced ham for a delicatessen.

The inventor is Hans Laube, a Swiss expert in osmology, the science of odors.

The patent explains that after a motion picture is made it is cued for odor signals. The various scents used, such as wood, cocoa, rose, peach, honey and violet are stored in a "battery of cells." As the scent machine picks up a signal, it dips a nozzle into one of the cells and pumps out the perfume. The perfumes used contain no fixatives to make them last longer; if they don't disappear quickly enough the room is sprayed with a fixative before the next odor appears.

Mr. Laube's most recent experiments have been with supermarket displays. Slides of various products are accompanied by such odors as orange, lemon, goulash, cheese, banana, smoked ham, and chocolate pie. The inventor also sees a future for synchronized perfume emissions from television sets.

Scentovision first appeared on the scene two years ago, when a working model was set up in a New York theater. A 10-minute pilot film with 17 scenes and 17 odors was shown experimentally to a private audience.

Backers of the process hope to interest theaters in permanent installations when they get a full-length film.

for the home

Outdoor Thermometer Sticks to Window

Folks who hate to open drafty doors during the drizzly March weather to read the thermometer will welcome a transparent, plastic thermometer that sticks to the outside of the window by a self-adhesive frame. The dial is 2 inches by 3 inches and has a bright red needle and numbers that can be read from 10 feet away. It's available from Sunset House, Los Angeles, Calif.

Armchair Snack Table

If you're tired of balancing a coffee cup or sandwich plate on your knee while watching TV, a small, formica-surfaced hardwood "table" that fits over the arm of a chair may be the answer. The table, also handy for buffet suppers, has a serving area that is roughly 7 by 9 inches. Available from Mansfield House, New York City, the table is adjustable to fit any chair.

Device Filters Iron From Water Supply

Homeowners can eliminate the rusty water problem with a new automatic filter machine.

The "Filter-All," manufactured by the Electronic Water Purifier Co. of Chicago, removes iron by making it combine with oxygen in water to form a hydroxide. The accumulated iron is flushed out of the tank automatically by a special timing device. The catalyst is described by the manufacturer as a granular material that is insoluble, permanent, and almost indestructible. No chemicals are needed to clean the machine, the manufacturers state.

WHERE WILL YOU GO IN FLORIDA?

Florida needn't be expensive—not if you know just where to go for whatever you seek in Florida. And if there's any man who can give you the facts you want, it's Norman Ford, founder of the world-famous Globetrotters Club. (Yes, Florida is his home whenever he isn't traveling!)

His big book, Norman Ford's Florida, tells you first of all, road by road, mile by mile, everything you'll find in Florida, whether you're on vacation, or looking over job, business, real estate, or retirement prospects.

Through his experienced advice you learn exactly where you can retire now on the money you've got, whether it's a little or a lot. (If you need a part-time or seasonal job to help out your income, he tells you where to pick up extra income.) Because Norman Ford always tells you where life in Florida is pleasantest on a small income, he can help you take life easy now.

If you're going to Florida for a job with a future or a business of your own, his talks with hundreds of business men and state officials, etc., let him pinpoint the towns you want to know about. If you've ever wanted to run a tourist court or own an orange grove, he tells you today's inside story of these popular investments.

Yes, no matter what you seek in Florida, this big book (with well over 100,000 words and plenty of maps) gives you the facts you want. Price — only $2, only a fraction of the money you'd spend needlessly if you went to Florida blind. Use coupon to order.

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